

17th

MISCELLANEOUS TRACTS
RELATING TO
NATURAL HISTORY,
HUSBANDRY,
AND
PHYSICK.

Translated from the Latin, with Notes

By BENJ. STILLINGFLEET.

Homo naturæ minister et interpres tantum facit et intelligit,
quantum de naturæ ordine, re vel mente observaverit: nec
amplius scit vel potest. BACON.

Primus gradus sapientiæ est res ipsas nosse; quæ notitia consistit
in vera idea objectorum; objecta distinguuntur et noscuntur
ex methodica illorum *divisione* et conveniente *denominatione*;
adeoque divisio et denominatio fundamentum nostræ scientiæ
erit. LINN.

H. Linnæus (C.)



L O N D O N, Printed:
And sold by R. and J. DODSLEY, in Pall-Mall;
S. BAKER, in York-Street, Covent-Garden;
And M. COOPER, in Pater-noster-row.

MDCCLIX.

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MISCELLANEOUS TRACTS

RELATING TO

NATURAL HISTORY,

HUSBANDRY,

PHYSICS,

J. Roberts

Translated from the Latin, with Notes

BY BENJAMIN MARTIN

For Banks

Homo naturae munus, quod est, et intelligit,
quodam de naturae ordine, et non
arbitrio, ut vel potest.

Primum gradus sapientiae est, res ipsas nosse; quod nobis constitit
in vera idea objectorum; objecta distinguere et nominare
ex methodica illorum & ordine et convenientia, &c.
ad hocque divinis et demonstratis fundamentis nosse peritiam
esse.




LONDON, Printed:

And sold by R. and J. DODSLEY, in Pall-Mall;

S. PARKER, in York-Street, Covent-Garden;

And M. COOPER, in Paternoster-row.

MDCCLXX.


TO THE
RIGHT HONORABLE
George, Lord Lyttelton,
Baron of FRANKLEY.

MY LORD,
BESIDES private motives of
respect and honor, there is
another of a public nature, which
makes me desirous to inscribe the
following sheets to Your Lordship.
I mean the zeal which You shewed
in Parliament for securing to this
Country that noble collection of na-
tural curiosities now repositied in the
British Museum; which cannot fail
A 2 in

DEDICATION.

in time to produce many good effects, and prove the truth of what Your Lordship observed, that the reputation and interest of the nation were highly concerned in that purchase. I am, with the greatest regard,

MY LORD,

Your Lordship's most Obliged

and Humble Servant,

BENJ. STILLINGFLEET.



P R E F A C E
O F T H E
T R A N S L A T O R.

THE following pieces were selected from many others published by several ingenious members of that great, and hitherto unrivalled school of natural history, the university of Upsal in Sweden, under the presidency of Linnæus. They were selected not as the only, or even the most valuable, but as answering best the intention of the translator; which was to make known more generally how far all mankind is concerned in the study of natural history, and thereby to incite such as are properly quali-

fied to prosecute, and encourage that branch of knowledge, and spread, as far as the nature of the thing is capable of, amongst all orders of men in this nation, the improvements made in it by the excellent Linnaeus. His name, it must be confessed, has been for some time past in the mouths of people, but his works, i imagine, are little known except to a few virtuosi who have a more than ordinary curiosity, and ardor to look into the minute parts of nature. It cannot indeed be otherwise. For to understand him and to make use of his method, requires more patience and time than are likely to fall to the share of the generality of the world. My design therefore is not to exhort people indiscriminately to study his works; but, as i observed before, to give them some idea how usefull his pursuits are likely to become in many respects. There will appear, i imagine, such great and extensive views in relation to husbandry, physic; and the general oeconomy of human life in the few specimens i have given, that in this age, and nation, where every art and science, that can be of any use to the public, are

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are sure to meet with generous encouragers, there will be found many who will readily promote any rational endeavour to push these discoveries farther, or put in practice such hints, as may seem to bear a probable appearance of success.

I can scarcely condemn mankind for treating with contempt a virtuoso whom they see employed in poring over a morsel or an insect day after day, and spending his life in such seemingly unimportant and barren speculations. The first and most natural reflections that will arise on this occasion must be to the disadvantage of such pursuits. Yet were the whole scene of nature laid open to our view, were we admitted to behold the connections and dependencies of every thing on every other, and to trace the oeconomy of nature thro' the smaller as well as greater parts of this globe, we might perhaps be obliged to own we were mistaken; that the Supreme Architect had contrived his works in such a manner, that we cannot properly be said to be unconcerned in any one of them; and there-

fore that studies which seem upon a slight view to be quite useless, may in the end appear to be of no small importance to mankind. Nay were we only to look back into the history of arts and sciences, we must be convinced that we are apt to judge over-hastily of things of this nature. We should there find many proofs, that he who gave this instinctive curiosity to some of his creatures, gave it for good and great purposes, and that he rewards with usefull discoveries all these minute researches.

It is true this does not always happen to the searcher, or his contemporaries, nor even sometimes to the immediate succeeding generation; but i am apt to think that advantages of one kind or other always accrue to mankind from such pursuits. Some men are born to observe and record what perhaps by itself is perfectly useless, but yet of great importance, to another who follows and goes a step farther still as useless. To him another succeeds, and thus by degrees; till at last one of a superior genius comes, who laying all that has been done before his time

together

together brings on a new face of things, improves, adorns, exalts human society.

All those speculations concerning lines and numbers so ardently pursued, and so exquisitely conducted by the Grecians; what did they aim at? or what did they produce for ages? A little arithmetic, and the first elements of geometry, were all they had need of. This Plato asserts, and tho' as being himself an able mathematician and remarkably fond of these sciences, he recommends the study of them, yet he makes use of motives that have no relation to the common purposes of life.

When Kepler, from a blind and strong impulse merely to find analogies in nature, discovered that famous one between the distances of the several planets from the sun, and the periods in which they complete their revolutions; of what importance was it to him or to the world?

Again; when Galileo, pushed on by the same irresistible curiosity, found out the law

by

by which bodies fall to the earth, did he or could he foresee that any good would come from his ingenious theorems, or was any immediate use made of them?

Yet had not the Greeks pushed their abstract speculations so far, had not Kepler and Galileo made the above mentioned discoveries; we never could have seen the greatest work that ever came from the hands of man. Every one will guess that I mean Sir Isaac Newton's Principia.

Some obscure person, whose name is not so much as known, diverting himself idly as a stander-by would have thought, with trying experiments on a seemingly contemptible piece of stone, found out a guide for mariners on the ocean, and such a guide as no science, however subtle and sublime its speculations may be, however wonderful its conclusions, would ever have arrived at. It was bare curiosity that put Sir Thomas Milington upon examining the minute parts of flowers; but his discoveries have produced the most perfect, and most usefull system of botany that the world has yet seen.

Other

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Other instances might be produced to prove, that bare curiosity in one age is the source of the greatest utility in another. And what has frequently been said of phymists may be applied to every other kind of virtuosi. They hunt perhaps after chimaras and impossibilities, they find something really valuable by the bye. We are but instruments under the Supreme Director, and do not so much as know in many cases what is of most importance for us to search after. But we may be sure of one thing, viz. that if we study and follow nature, whatever paths we are led into, we shall at last arrive at something valuable to ourselves and others, but of what kind we must be content to remain ignorant.

I am sensible that after all i have said, or can say, many people will not be persuaded to allow that the study of some parts of natural history can be worthy of a rational creature. They will never vouchsafe to look on moles and insects in this light. Yet why may not the study of these likewise have its use in future times? It ought to be considered

dered that the number of the latter is immense, that it is but lately that any great attention has been paid to them, that one of them is and has been long the means of cloathing thousands and feeding more, that another affords us honey, another a fine dye, not to mention some few besides, of acknowledged benefit to mankind. Lastly, that they are capable of doing us the greatest mischief, and that it is possible that a more thorough knowledge of them may instruct us how to secure ourselves against their attacks. Whether this be possible we can never know, till proper encouragement has been given to this branch of natural history. Something to the same purpose might be said concerning moles, but as the intent of one of the following pieces is principally to take off such objections as i have been considering, i shall dwell no longer on this subject; but proceed to give a short account of what Linnaeus has done towards the improvement of natural history, that the reader, who is unacquainted with his works, may form some idea, tho' very imperfect, of this great man. First then, he

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he has invented a new system of botany, founded on the male and female organs of generation in plants, a system which has thrown a new light over botany. He has defined about 10,000 plants, ranged them into classes, genera, and species, given new and regular generical names to many instead of those barbarous and uncouth ones which prevailed till his time, and added specifical names to all, short, easy, and oftentimes significant, a thing never so much as attempted before. He has brought into botany, a precision, conciseness and elegance, that were very much wanted. He has observed and given names to some parts of plants not taken notice of by any other botanist, parts which in some cases are sufficient as well as necessary to distinguish the genus and the species.

The *philosophia botanica* * of this author affords throughout instances of this reformation.

* In the year 1750. when he was writing this book, as he tells us in the preface to it, he was hindered from going on by a terrible fit of the gout, that broke the strength of his mind as well as body. In the year 1755, he says, *Flor. Suec.* article 450. that he had been freed from the gout for

tion. Had he wrote no other book but this, he would have deserved the highest praise from all lovers of botany. For besides the improvements just mentioned, it comprehends in a short compass something of consequence in every branch of that part of natural history, and affords hints for various discoveries, hints that must, if pursued, produce many considerable improvements in physic, husbandry, and oeconomy.

He has published a materia medica so far as relates to plants, in which he has undertaken to determine many species commonly used but not sufficiently ascertained, adding throughout in the shortest manner possible what he has found to be useless or efficacious, and as he assures us never highly recommends any without being thoroughly convinced of their vertues by his own experience in the hospitals where he presided. Some of these medicines have not yet, i be-

for some years by eating great quantities of fresh strawberries. He adds that this fruit dissolves the tartar of the teeth, that it is remarkably good for people afflicted with the stone or gout, and that it may be safely eaten in abundance.

lieve,

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lieve; been received into our shops, but they may possibly deserve consideration.

In the last edition of his *Systema naturæ* he has mentioned above 1500 species of insects, has classed them all, divided them into genera and species, described them as to the minutest parts so far as was necessary to distinguish them, marked the places where they are to be found, the plants they feed upon, their transformations, cited the authors who have treated on them, given them classical, generical, and trivial or specific names; has done the same by birds, fishes, and all other known animals; has ranged all the fossils, minerals and stones, to use his language, in a manner partly borrowed, and partly founded on his own observations. But what improvements and additions he has lately made to this part of natural history, as well as that of plants, we cannot say till the other part of his new edition of the *System* of nature comes out, which is expected daily. However what we see he has done in relation to animals, leaves us no room to doubt but that it will

all

Canada

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all together be the most extraordinary book that was ever published in this or almost any other way.

Besides his writings, of which i have mentioned but a small part, this indefatigable man, born to be nature's historian, has travelled over Lapland, all Sweden, part of Norway, Denmark, Germany, Holland, England, and France, in search of knowledge. That part of his travels which is published in Latin has many curious and useful observations relating to the purposes of common life. Of those which are written in his own tongue i cannot give any other account, but that by some quotations from them to be found in the writings of his disciples it appears, that they very well deserve to be communicated to the world in a language more generally understood.

Besides these labours of his own, the world will be one day obliged to him for what others have done. Incited by his example and persuasion, C. Ternstrom went into Asia; P. Kalmius to Pensilvania and
Canada;

Canada; L. Montin into one part of Lapland; D. Selander into another; F. Hasselquist into Ægypt and Palestine; O. Toren to Malabar and Surat; P. Osbech to China and Java; P. Loeffling to Spain and America; P. J. Berg to Gothland; M. Koehler to Italy and Apulia; and D. Rolander to Surinam and St. Eustacia; all these with a view to the promotion of natural history. When we consider him in this light of a master of such disciples as these, and many others, some of whose works make up the following book, he must appear like Homer at the head of the poets, Socrates at the head of Greek moralists, and our Newton at the head of the mathematical philosophers. Among all these extraordinary qualifications there appear throughout his writings spirit, candor, a due regard for others, and proper modesty and diffidence of himself.

I will give a short specimen of his way of thinking in relation to the degree of human knowledge hitherto attained by man on the subject of natural history. A sub-
ject

ject on which it was very natural for a less extensive genius to be vain, as he has had so great a share himself in the advancement of it. The passage is taken out of the introduction to the new edition of his System of nature, and is to this effect. 'How small a part of the great works of nature is laid open to our eyes, and how many things are going on in secret which we know nothing of! How many things are there which this age first was acquainted with! How many things that we are ignorant of will come to light when all memory of us shall be no more! For nature does not at once reveal all her secrets. We are apt to look on ourselves as already admitted into the sanctuary of her temple, we are still only in the porch. I have entered, adds he, into the thick and shady woods of nature, which are everywhere beset with thorns and briars. I have endeavoured as much as possible to keep clear of them, but experience has taught me that there is no man so circumspect as never to forget himself, and therefore i have born with patience the sneers of the malevolent, and the buffoneries of those whose

whose vivacity is exerted only to molest and give offence to others. I have in spite of these insults, kept on steadily in my old path, and have finished the course I was destined for.

The latter part of this passage, shews that he has not been without his enemies, and that he has suffered in the same way that all the most curious enquirers into nature have done in all ages. The tartness of his expressions, which is still stronger in the original, plainly proves that they have not used fair arguments against him, but like interested rivals, or men of a superficial understanding, have endeavoured to subject him and his labours to ridicule. But whatever has been his fate in his own country, as far as i know, his name is almost universally mentioned with respect in all other parts of Europe. It is true, objections have been made to his innovations in other places besides Sweden, which must unavoidably happen on many accounts, but particularly because those natural historians who had been brought up and inured to other systems, who

had learned things by other names, and could not easily attain the new ones, must have strong prejudices arise on this occasion. This objection being personal i shall not consider it any farther, but readily allow that great indulgence is due to such people, and that their fate is to be pitied for coming into the world too soon to be enlightened farther on subjects, that perhaps had employed the greatest part of their life. But there are prejudices of another sort which i cannot omit to consider more fully on this occasion.

In order to this it must be premised, that the use and intent of a classical system in any part of natural history, is not to range things according to their natural connections in regard to their outward aspects, or essential qualities, or their medicinal or oeconomic properties, but to range them in such a manner that upon a plant, mineral or animal being shewn to a naturalist he may certainly, upon a due inspection of the object, give its true name according to some system. He who goes farther than this is not barely

a na-

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a naturalist, but something more, viz. a physician, a chymist, a farmer, a gardener, &c. And he who cannot go thus far to a certain degree, does not deserve the name of a naturalist, however skillfull he may be in the vertues and properties of bodies animate or inanimate.

The use then and intent of a classifical system is nothing more than that of a dictionary, where no one complains that words totally unconnected in sense are put near one another. The question therefore as to the sexual system^b, v. g. in plants, is not whether they be ranged naturally, but whether in the best manner possible in order to be known. Nay farther, it matters not whether the sexual system be founded on nature or not, i. e. whether there be any propagation by seeds without male and female organs of generation. The whole to be considered is whether those parts which are called, and,

*Defence
of Linnæan
System.*

^b At the end of the preface i have endeavoured to explain the meaning of these terms in such a manner, that i think any curious person that will be at the pains to compare my explication with nature, cannot fail to understand perfectly what they mean in general. I thought this method would be more agreeable to the reader than to be referred to other books;

i believe truly called so, do really exist, and whether they for the most part exist so uniformly, as to furnish marks sufficient to distinguish the classes, &c. by. Nor does it matter whether it be hard to distinguish those marks, but whether they can with proper care and patience be distinguished, and whether we can surely distinguish plants, without observing those nice and minute parts, and whether a system has been found equally sure with the Linnæan without having regard to those parts. Those who think so would do well to inform the world of their discovery, and not make objections that affect only the obscurity of nature, when they mean to condemn a system which is obscure merely from its consonancy to nature. If Providence has thought fit to write in cyphers, shall he be blamed who endeavours to give a key to its works, because some men cannot distinguish one stroke from another in the cypher?

Those who have not learned to read the characters of nature for want of leisure, patience, or any other cause, ought not to complain that Linnæus cannot make them skillfull

skillfull in a part of knowledge they are not qualified for. If a man unacquainted with the learned languages wants to know the meaning of a Greek word, will he complain of the lexicon, because he cannot find it? certainly not. Neither ought we to complain of Linnaeus in a similar case.

This i think is a full answer to all the objections that have or can be made to his system in general. What errors he has committed according to his own principles in relation to particulars is quite another question. I am one of those who think him not free from errors. Nor is it wonderfull that he should fall into some, but it is truly wonderfull that one man should be able to invent and carry so far so nice and extensive a system, especially when we consider not only what he has done in botany but what he has done in all the branches of natural history besides, and some of them almost entirely neglected before his time. I should therefore wish that those who are fond of this part of knowledge would, instead of making frivolous objections, try by

an accurate and diligent examination to rectify his mistakes, and thereby help to perfect a system which deserves the utmost attention, and commendation.

Tho' i said above that it matters not whether the sexual system be founded on nature or not, yet it was natural for the inventor of it to endeavour by all proper means to vindicate it as likely to be so, and this he has done to the satisfaction of the most curious observers; and i will venture to add, that it is natural for others likewise to embrace with zeal a system, that puts the works of Providence in so new and beautiful a light by continuing the analogy from the animate to the inanimate creation. It seems as if Providence intended to lead men to this discovery by striking our senses so intensely and so agreeably with those very parts which contain the clue of this system. Yet such is the inattention and inaccuracy of man on certain points, that even a tolerable conjecture concerning the use of those parts was not made till the year 1676.

Having

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Having finished all that I think necessary to say concerning Linnæus and his works, i shall now come to what relates immediately to myself only. First then as to the translation, I have endeavoured to avoid making it too literal, and servile, but yet i hope without taking any undue liberties, or deviating from the sense of the originals.

The part which is likely to prove least agreeable to the reader, is that which was most troublesome to the translator. I mean the names of things not generally known. Some of these i have been obliged to leave in Latin, not being able to find any English names for them. I will not pretend to have avoided all mistakes on this head, but it is certain i should have committed more, as well as have had much more trouble, had it not been for the assistance of the ingenious Mr. Hudson, whose skill in all the branches of natural history, and particularly those relating to his profession as an apothecary, cannot fail to recommend him to the favor of the public. To him i likewise owe the as-
certaining

certaining of some of the grasses, one of which, viz. the small bent grass which i had in my collection, but knew not where i found it, he discovered to be the *gramen minimum anglo-britanum*, mentioned in the *indculus plantarum dubiarum* at the end of Ray's Synopsis.

I must not omit also on this occasion to acknowledge my obligation to that excellent botanist Dr. Watson, for favouring me with the perusal of his collection of grasses, which was of no small service to me.

But to return to the translation; I said that i did not pretend to have avoided all mistakes in relation to the names of things, i will now extend this farther, and own my suspicions that i may have made some in relation to other particulars, but i hope they are of such a kind only as may be looked on with indulgence by the learned, especially when they consider the great variety of subjects treated on in these pages, of none of which subjects i profess to be a master, and therefore do not undertake to teach such readers; but on
the

the contrary shall always be ready and even desirous to receive instructions from them. I beg they will also consider that I do not aim at letting the unlearned into the mysteries of this part of knowledge, or even teaching them the elements of it. My business is only to excite curiosity, and therefore small errors can be of no consequence. What I have farther to say will be found in notes, some of which were by mistake omitted in their proper places, and therefore i have throwp them into an appendix.

Res summas initio deberi parvo ac debili experientia omnium temporum testatur. Amæniti. Acad, vol, 2. p. 266. §. 2.

End of the P R E F A C E.

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IN order to explain the sexual system, I shall make use of the lilly, as that plant is almost every where to be found, and as the parts of generation are in that more obvious, than perhaps in any other flower. Upon opening the flower leaves there will appear in the very center, at the bottom, an oblong thickish substance with six furrows along its sides. This contains the seeds, and is called the

The germen or germ.

On this stands a small kind of pillar called

The style.

Which is terminated by a thickish triangular head, called

The stigma.

These all together form the female part of the flower, and are called by one name,

The pistil.

Round this pistil grow six long thready substances, called

The filaments,

Each

Each terminated by an oblong body, that plays as on a pivot, upon the least motion being given to the flower, and is called

The anthera.

This anthera contains the male dust, which when ripe is scattered about by every breath of air, and what happens to fall on the stigma, or upper part of the pistil, is supposed to enter thro' the style into the germ, and there impregnate the seed.

This plant is called an hermaphrodite, because the male and female organs of generation are contained within one flower. Most plants are hermaphrodites, like this, and have something analogous to what I have described above. Some plants have the male and female parts separate on the same individual ; others have male parts on one plant and female on another.

The part of the flower that contains honey is called

The nectary.

Only

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Only a few plants have this part, the lily has it, but as the knowledge of it is not necessary for understanding the following pieces, I shall not trouble the reader with a description of it.



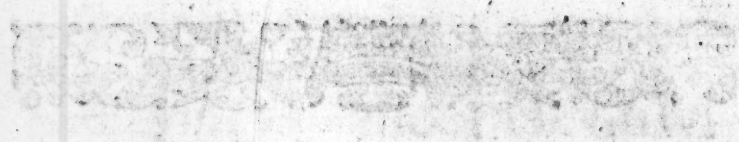
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Miscellaneous Tracts, &c.

An ORATION concerning the necessity of travelling in one's own country, made by Dr. LINNÆUS at Upsal, Oct. 17, anno 1741, when he was admitted to the royal and ordinary profession of physic.

Amænitat. Academ. vol. ii.

MOST honourable and most learned auditors of all orders, i am going to undertake a province, allotted to me by the favor of our most august, and most potent monarch, whose will it is that i preside over, and direct the study of physic in this University; and that i do my utmost to advance the glory of this illustrious body. May his choice be crowned with success, and may the great and good God favor my undertaking.

As by custom, delivered down by our forefathers, and prescribed by the laws of our academy, i am obliged upon undertaking this province to say something before so illustrious a

circle of fathers and citizens; i confess that all those circumstances, each of which is apt to strike terror into the mind of man, offer themselves together in a croud before my eyes on this occasion. For whether i consider the ampleness of the place, or the dignity of the audience, or the multitude of chosen people, or lastly my little talents in the arts of speech; all these circumstances, i ingenuously confess, throw me into no small confusion.

For if the most eloquent men, when they come to speak in public, have been known to tremble, and become incapable of uttering a single word; what must i feel who have none of the common advantages, either from art or nature, in the readiness and elegance of speech?

However, since i am under a necessity of saying something, i must fly for refuge to that favor, and humanity, which you never refuse to those who speak on these occasions; and thus i doubt not but that, however deficient i may be from want of talents or want of exercise, i shall not wholly fail of the end i aim at. I shall therefore, most honorable auditors, undertake to treat on a subject neither unsuitable to the present occasion, nor to the office i am going to enter into, nor to that employment i was lately engaged in by the will, and suffrage of the high, and mighty states of this kingdom; and from which i am

about

now

now once again brought back to this seat of the muses. Nay so far is the subject, i am about to treat on, from being unsuitable to any of these circumstances, that it seems to me particularly adapted to every one of them. The subject is concerning the necessity of travelling in one's own countrey, and the advantages that may thence accrue, especially to physicians. I shall treat it in a plain, and popular manner; and endeavour to manage it so, that the meanness of my language may be compensated by the dignity of the matter, and the brevity of my expressions.

All human knowledge is built on two foundations; reason and experience.—These two joyned together are necessary to make a good physician.

We must confess indeed, that the business of reasoning may be carried on with equal success in our closets, as in travelling, supposing we have an opportunity of conversing with men truly learned.

But it was experience, that sovereign mistress, without which a physician ought to be ashamed to open his lips; it was experience, i say, that consecrated to immortality so many of the antients, and amongst the rest that divine old man Hippocrates; whose writings were published many ages before christianity. The writings of this wonderful man alone, among so many ingeniously contrived systems, remain to this day, and will for ever remain firm, unmoved,

unshaken, untouched by any decay, by any change. It is experience that has adorned with laurels the heads of so many celebrated physicians in all times, and even now adorns. And hence it is that the chief and most honorable title of physician is to be called a man of great experience. Experience ought to go first; reasoning should follow. The former furnishes the materials of knowledge; the latter holds her consultations on the given phenomena; and when she has weighed with judgment every circumstance, she discovers truth, and concludes, orders, and determines rightly about the point in question. Experience ought to be animated by reason in all physical affairs; without this she is void of order, void of energy, void of life. On the other hand reason without experience can do nothing, being nothing, but the mere dreams, phantasms, and meteors of ingenious men who abuse their time. The ancients certainly did not, any more than we, bring experience into the world with them. There is need of much diligence, and labor, before man can be thoroughly instructed. Dioscorides confesses, that he undertook many journies in order to increase experience; and the other fathers of physic in their writings frequently make mention of their travels either expressly, or tacitly.

Academics

Academies were instituted to the end, that men well versed in all kinds of literature, and enriched besides by much experience, might be invited thither, and that the youth, who were ambitious of becoming learned, might flock together to those seats; and have the advantage of improving no less by the experience, than by the erudition of the professors; and these qualifications combined together, which is of all alliances the most pleasing, very justly deserve the utmost veneration and respect.

Vast and sumptuous libraries are erected in academies; in which the observations of the learned, like so many legacies, and donations, are preserved; that they, who diligently give themselves up to study, may become endued with learning, polished, and confirmed by experience. These libraries are the repositories of wisdom, and their stores are laid open to every ingenious candidate.

Hospitals are founded, that the candidates of physic may learn those things at the patients bed side, which cannot be learned from books; for here practice, and experience shew their force by means of the eyes, and hands; as he paints any object most accurately, who paints from the idea, which his own eyes afford him, and not from that, which he gets by the relation of another.

Anatomy schools are erected, that we may behold in another's body, as it were in a glass, the nature, and constitution of our own; as those conceive more clearly the situation of countries, districts, and cities, and the manners, rites, and customs of their inhabitants, who themselves have been there, and have seen what is remarkable amongst them with their own eyes, than he who relies solely upon the vague, and imperfect maps, and relations of travellers.

Physic gardens are here cultivated; where the plants of various kinds are collected from all parts of the globe, that we may by this means behold, as it were, the great in the little world.

Hither instruments for experimental philosophy are brought together, that the abstruse forces of the elements, which otherwise would escape our senses, may be made manifest, and that so we may successfully be led into the very recesses of nature; as far as human penetration will admit of.

Here repositories for the curious works of art, and nature are made; that at one view we may behold their sports, as it were, and wonders.

All these things are instituted in academies, that the youth may arrive at knowledge by experience; all tend to this end that tho' we be confined to one spot, one corner of the earth, we may examine the great and various stores of knowledge,

ledge, and therein behold the immense domains of nature, and get acquainted with such things, as otherwise must be sought for, and oftentimes in vain, over the whole globe.

In my opinion therefore studying at academies ought by no means to be neglected, but rather should be looked on as necessary to those, who are ambitious of attaining wisdom, supported by experience. And those who endeavour to instill into the minds of young people a contempt for universities, and to withdraw the studious from these seats of learning, suggest very pernicious advice; not considering that in these storehouses of knowledge much greater, and more excellent things may be attained by means of experience in a very short space of time, than by the most multifarious, most indefatigable, and most extensive reading at home all one's life.

If i may be allowed to speak what is really fact, this our university may contend with any forreign one whatever for true, and solid learning in all those parts of knowledge, which i have enumerated, owing to our noble, and exemplary institutions. For we begin to excell in botanical gardens, in hospitals, in apparatus's for experimental philosophy, in anatomical preparations, and other helps for arts and sciences, and to excell so much that we are likely in time,

by the blessing of the almighty, to be inferior to no university.

Although some universities excell others on account of certain advantages peculiar to themselves ; for in proportion as one kind of knowledge in this, or that nation is held in greater, or less esteem, and is therefore more or less cultivated, so the professors of it will be more or less skillful ; as at this time the hospitals at London both for number and goodness exceed all others, at Paris chirurgical operations, at Leyden anatomical preparations, at Oxford botanical collections ; tho', i say, this may be the case, yet i cannot think, that those act prudently, or enough consult the good of themselves, and countrey, who seek for that abroad, which may be had at home, and who travel to forreign universities, before they have laid a sufficient foundation in their own countrey. And there is no doubt but that they who do so will at last repent of their error. He, who goes abroad raw, and ignorant, seldom returns more learned. Whereas he, who has spent his time well at his own university, will never find reason to repent. Whoever has employed himself properly in the study of the arts, and sciences will become an usefull, and solid man in every branch of business. Whoever, before he sets out to visit regions warmed by other sons, has laid the first foundations of his studies

studies in his native countrey, will be most likely to bring back materials of far greater price, than we usually see amongst the greatest part of our travellers, who seldom return home laden with any thing, but fine sounding, and empty words collected out of the European languages. What do they learn, but to prate about theatres, and plays, and the modes of dress amongst the Italians, the Spaniards, the Germans, and above all the French? If they were well advised they would not stir a foot out of their own countrey; that they might not destroy their fortunes, their time, their health, nay their very life itself by luxury, and voluptuousness. They would not then return, as too frequently happens, entirely useless to themselves, and countrey, and a burthen upon the face of the earth. But whither am i hurried?

My design was, in the little time allotted me, to speak to you, gentlemen, not of the peculiar advantages of universities, or of sojourning at this, rather than any forreign one; but chiefly of travelling in one's own countrey, thro' its fields, and roads; a kind of travelling, i confess, hitherto little used, and which is looked upon as fit only for amusement. I once more, most honorable auditors, beg your patience, and that i may not forfeit all right to your favor, and benevolence,

i proq:

i promise to be as short as possible. You know the poet says,

The farmer talks of grasses and of grain,

The sailor tells you stories of the main.

You ought not therefore to wonder, that i choose to make travelling in one's own countrey the subject of my discourse. Every one thinks well of what belongs to himself, and every one has pleasures peculiar to himself. I have travelled about, and passed over on foot the frosty mountains of Lapland, have climbed up the craggy ridges of Norland, and wandered along its steep hills, and almost impenetrable woods. I have made large excursions into the forests of Dalecarlia, the groves of Gothland, the heaths of Smoland, and the unbounded plains of Scania. There is scarcely any considerable province of Sweden, which i have not crawled thro', and examined; not without great fatigue of body and mind. My journey to Lapland was indeed an undertaking of immense labor; and i must confess, that i was forced to undergo more labor, and danger in travelling thro' this one tract of the northern world, than thro' all those foreign countreys put together, which i have ever visited; tho' even these have cost me no small pains, and have not a little exhausted my vigor. But love to truth, and gratitude towards the supreme being oblige me to confess, that no sooner were my travels finished,

finished, but, as it were, a Lethæan oblivion of all the dangers, and difficulties came upon me; being rewarded by the inestimable advantages, which i reaped from those devious pursuits. Advantages, the more conspicuous for that i became daily more and more skillful, and gained a degree of experience, which i hope will be of use to myself, and others; and, what i esteem above all other considerations; as it comprehends in one all other duties, and charities; to my countrey; and the public.

Good God! how many, ignorant of their own countrey, run eagerly into forreign regions, to search out and admire whatever curiosities are to be found; many of which are much inferior to those, which offer themselves to our eyes at home. I have yet beheld no forreign land, that abounds more with natural curiosities of all kinds, than our own. None which presents so many, so great, so wonderfull works of nature; whether we consider the magazines of snow heaped up for so many ages upon our Alps, and amongst these vast tracks of snow green meadows, and delicious vallies here and there peeping forth, or the lofty heads of mountains, the craggy precipices of rocks, or the sun lying concealed from our eyes for so many months, and thence a thick Cimmerian darkness spread over our hemisphere, or else at another season darting his rays continually along
the

the horizon. The like to all which in kind, and degree, neither Holland, nor France, nor Britain, nor Germany, nor lastly any countrey in Europe can shew ; yet thither our youth greedy of novelty flock in troops. But it was not my intent to speak of these things at present. I come now closer to my purpose, being about to shew by instances, that the natural philosopher, the mineralogist, the botanist, the zoologist, the physician, the oeconomist, and all others, initiated in any part of natural knowledge, may find in travelling thro' our own countrey things, which they will own they never dreamed of before. Nay things which to this day were never discovered by any person whatever. Lastly such things, as may not only gratify, and satiate their curiosity ; but may be of service to themselves, their countrey and all the world.

To give a few examples. The sagacious searcher after nature will find here, wherewithall to sharpen, and exercise his attention in beholding the top of mount Swucku, of so immense a height, that it reaches above the clouds. The wonderfull structure of mount Torsburg, the horrid precipices of the rock Blakulla in an island of that name, situated near Oeland, and that presents by its name, still used among the Sueogothic vulgar, no less than by its dismal aspect, an idea of the stupidity, and superstition of that antient people.

Besides

Besides the wonderful vaults, and caverns of the Skiula mountains, the high plains of the island Carolina, the unusual form and structure of the Kierkerfian fountains in Oeland; to pass over numberless other strange works of nature, the like to which perhaps are no where to be met with.

Where can we have greater opportunities, than in this Sueogothic tract, of considering the intense rigor, and vehemence of winter, the incredible marble-like strength of ice. And yet in this inclement climate grain of all sorts is observed to spring forth sooner, grow quicker, and ripen in less time than in any other part of the world.*

Whoever desires to contemplate the stupendous metamorphoses of sea, and land, will scarcely find any where a more convenient opportunity, than in the south, and east parts of Gothland; where the rock-giants, as they are called, seem to threaten heaven, and where the epocha's of time, the ages, the years, if i may so say, are as it were carved out in a surprising series upon the sea shore, and the ground above the shore.

* Vid. a treatise concerning the foliation of trees published in this collection, and the prolegomena to the Flora Lapponica of this author, where he says that at Purkyaur in Lapland anno 1732. barley sown May 31. was ripe July 28. i. e. in 58 days; and rye sown May 31. was ripe, and cut Aug. 5. i. e. in 66 days.

The philosopher will find room to exercise his ingenuity sufficiently in the Oeland-stone, by trying to discover how to overcome its moist nature, and quality, which whoever could accomplish would do no small service to his country, and above all would infinitely oblige the inhabitants of that place.

I shall say no more than what is known, and confessed by all the world, when I say that there is no country in the habitable part of the globe, where the mineralogist may make greater progress in his art, than in this our country. Let any one, that can, tell me, and I shall esteem him no mean prophet, in what regions, more rich, and ample mines of metal are found, than in Sweden, and where they dig deeper into the very bowels of the earth than here.

Let the mines of Norburg, the ridge of Taberga, the pits of Dannemore, Bitsberg, Grengia, and lastly the immense treasures of Salbergen, and Fahluna be my witnesses, which exceed all in the known world.

Where do the possessors suffer foreigners more freely to approach their furnaces, and observe their operations? where are there men more ready to communicate their knowledge? Strangers are received by us with civility, and even pressed to stay.

Who

Who would not shudder on beholding those forges, vomiting forth immense clouds of fire, and smoak, where our iron ores are melted? who would not behold with pleasure the simple countryman in the thick pine-groves of Dalecarlia, without furnace, without any apparatus, extracting an iron so very hard, so fit for use, that it yields to no other, tho' prepared with the fiercest fires, and greatest expence?

Who ten years ago would have imagined, that the lapis calaminaris was to be had in Dalecarlia? or mines of the very best kind of gold in Smolandia?

You will perhaps scarce believe me when i tell you, that there are whole mountains full of petroleum in Dalecarlia. Yet doubt not. This thing hitherto unheard of, unseen, i myself saw with these eyes, and was surpris'd.

We admire at the abundance of coral on the Indian shores, yet the port of Capellus in Gothland alone equals, nay exceeds those riches of the east. I have seen deep strata of corals extending many furlongs, many miles along its shores.

Botanists, who have travelled over the greatest part of the globe in search of the treasures of the vegetable kingdom, have yet left many plants for us and our posterity to discover in these our regions. For there is scarce any where a greater variety of mosses, lichens, fuci, and fungi, than with

I should not this be furnaces

Lapis Calaminaris

Petroleum

Coral

with us; and the most curious botanists are now diligently employed in contemplating these minute plants.

Whoever beheld, or described our diapienia? who the blasia unless Micheli alone? These two kinds of plants grow with us, and the latter especially is found in great plenty about Fahluna. What traveller, that is not totally ignorant in botany, does not go from Paris to Fontainebleau to see those very rare orchis's, some of which represent helmets, others knats, others flies; all of them so exactly, so wonderfully, that there seems nothing wanting to make them the very animals themselves; but noise, and motion? who imagined these flowers grew in our countrey, and in such plenty in Oeland, that they are to be met with in every field?

Who would ever have thought of looking in our countrey for the following exotics. The winged pea, the great burnet, the perennial lettuce, the dwarf carline thistle, the middle fleabane, the black hellebore, the Illyric crowfoot, much less the riccia, and herb terrible, and especially the scorpion fena, that most beautifull shrub, which in winter is carefully guarded against the frosts in the stoves of our botanist? yet all these have lately been observed to grow in Oeland and Gothland.

Lichen verrucosus Ray. We
Lichen omnium minimus
foliolis scissis super terram
repansus. Dillen.

We used to purchase at a great price from foreigners the following medicinal plants, vervain, moneywort, &c. which are all natives of Sweden, and yet ten years ago no body knew this.

What expences have we been at yearly to get the glass-wort, of whose ashes, and salt glass is made. The dyers weed and woad were purchased yearly at a very high price; plants that we have at last found grow every where about our provinces.

Lapland alone furnished me some time ago with a hundred rare plants. I have gathered lately as many in the islands of the Baltic, and in Scania alone as many more, never before observed in Sweden. Nor can it be doubted, but that our other provinces conceal in their unfrequented corners other new plants, valuable for use or beauty, tho' hitherto overlooked, if a diligent and acute inquirer be not wanting. I will not say with the poet 'Happy the rural inhabitant, but happy the Swedish inhabitant if he knew but what good he is possessed of.^b

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The

^b Our country has been searched by so many able botanists for plants, that what is said here cannot be applied to us. But a curious traveller might be of great service in relation to plants even here by observing, and making generally known what plants are peculiarly cultivated in some countries. Thus for instance they sow lotus: 13. Linn. birds foot trefoil Ray syn. 334. in Herefordshire, which grows all over England

The zoologist will no where meet with a place more delightfull, and more suitable to his views, than that where flocks of all kinds of birds in spring time, and summer gather together to breed. This is the case in the woody, and mountainous parts of Sweden, more than in any other spot of the earth; the Lapland plover called pago, the Norland pied chaffinch, the Oeland tringa called alwargrim, the Gothland duck called eider, the artic duck of the island Carolina called torde, the Ottenbyensian cobbler's awl called sierfloecha, the picus tridactylus of the Dalecarlians are all more rare in other countries, than pheasants with us. I may venture to affirm that no countrey upon the face of the earth abounds more with birds and insects, than Sweden. Wild rein deer, flying squirrels, and the Norway rat that pours down in troops from the mountains into the plains below are unknown, and perhaps happily unknown, any where else.

Forreigners come into the Dalecarlian mountains to catch falcons, as is well known.

In the island Farô situated near Gothland whale and salmon fishery is very conveniently carried on, and no where with greater profit.

land on dry pastures, and is found very good for sheep, tho' every where else as far, as I know, neglected. Again they make great use of the common vetch in Gloucestershire, chiefly for horses, feeding them with it upon the spot, and eating it off time enough for turneps the same year.

How

How many species of fishes furnish our tables very common in Sweden, especially of the soft-mouthed kind; such as the asp, the wimba, the faren, the biorkna, the mudd, and others, unknown, undescribed, unseen in-forreign countries. Who ever dissected, examined, described those minute red serpents called asps, or æspingar by the southern Swedes, whose bite communicates a deadly poison?

It would be tedious were i to descend to the species of insects. The great Reaumur who has shewn a sagacity, and accuracy, before him unknown, in examining insects, upon seeing my collection of Swedish insects owned ingenuously, that my countrey alone contained more species of those animals, than any other known in the world.

The curious diatetic, whose business it is to inquire into the various ways of living among men, will scarcely find any place, where there are so many different kinds of food, as here. Here men vary in their food, as they vary in fortune, situation, and condition. And what is very remarkable, the inhabitants of this northern world have their peculiar customs, and rules of eating in every province, and territory. In Lapland they live without corn, or wine, without salt or any made liquor. Water, and
C 2
fish,

flesh, and preparations of these are their only sustenance.

In some places the countreyman lives in his smoaky, and sooty stove on the * corogonus when stinking; and bread made of the roots of the calla, or of the husks, and beards of grain pounded.

In some places they live upon stinking herring, and ropy whey called fyra; in other places on a food called assu, and artfau, and stinking fish; and yet they undergo much labor. In some places their food is turneps, and their drink made of juniper berries. Some live upon peas; others on buck wheat, others grow fat upon whale's flesh, to the astonishment of strangers.

In travelling thro' other countries you will hardly ever see so many different ways of living in this respect, as in the Swedish dominions, and where consequently the diætic philosopher may have so many opportunities of making his experiments.

The pathologist, who enquires into the causes of distempers, will not lose his time in travelling into these countries; as in every different province men are subject to peculiar diseases, which arise in a great measure from the different kinds of food, that prevail among them. He will no doubt hence be empowered to assign the true causes;

* A species of fish.

why the Norlander is infected with the scurvy, and why the Laplander on the contrary is free from it: why the same Laplander is subject to those terrible gripes, called by them ullem; why the Gothlander is chiefly afflicted with the hypochondriacal colic; why the West-Bothnians, who are more prolific, than any other people in our part of the world, lose most of their children in the cradle; why so many people are liable to the epilepsy in the territory of Verns, for the cause is slight in appearance, but very singular in its nature.

Why almost all the males in Orsobæa dye of consumptions before the age of 30.

To enumerate all the things, which we have particular opportunities of observing in relation to these affairs in our own countrey, would require no short treatise.

I am fully persuaded, that it is absolutely necessary for the young physician to travel thro' his own countrey, were it only for this reason, that relying upon his own strength he might daily become more diligent, gain experience, without which there can be no skill in physick, and bring the art which he professes to some degree of perfection. For it happens amongst us, and perhaps no where so frequently, that our common people have confidence in their physicians, and run in crouds to consult any one, that is

known to have taken a doctor's degree; in other countries they will scarcely trust a young physician with a favorite dog.

By following this course, and entering into practice, the young physician will perceive, whether medicines, oftentimes celebrated beyond all bounds of moderation, have that effect upon the patient, which we find mentioned in practical books. He will hear of many domestic remedies, unknown elsewhere, in use among the country people, that are looked upon as specific, and preferred to the most costly prescriptions; for during the consultation, the patient may reveal the secret, if the physician is prudent, and makes use of a little art.

What are those famous exotic remedies brought from either Indies, and purchased at so great a price. v. g. *sarsaparilla*, a species of *smilax*, *ipécacuanha*, a species of *honey-suckle*, *acmella*, a species of *hemp agrimony*, *contrayerva* of *Dorstenia*, and *simoruba* of *pistacia*, which in some diseases are reckoned specifics? what are all these, I say, but remedies approved by long use amongst the vulgar? and are not innumerable remedies used among our own country people of the same nature? were not all those I have enumerated found out by ^a barbarians, and when experience

had

^a Vid. vires plantarum Amœnitat. academ. vol. i. p. 403. where Brunnerus is quoted for saying, that the barbarians have

had shewn, that they were useful, and efficacious in many diseases, were they not thought worthy to be communicated to the rest of mankind? Let our young physician then learn, not to condemn, but accurately to remark those remedies, which are cried up amongst the common people. For he who boasts of knowing more of the virtues of simples, than what ^{the} taste, smell, ^{the} fructification, and experiments will suggest vehemently deceives, or is deceived.

have done more towards the advancement of physic, than the learned of all ages. In the same passage the following words of Tournefort are quoted, *que tout le travail des hommes n'a encore rien produit de si assuré, que deux ou trois drogues que les sauvages trouvent dans les bois.* The author subjoins to these quotations a list of twenty medicines with an &c. taken from barbarous nations, now used in our shops.

The curious reader may find in Dampier's voyages a very extraordinary instance of the skill of the savages of America in the chirurgical way. Wafer there gives an account of a cure performed upon himself by these people, and his testimony is the stronger, as he was a surgeon himself.

e Vid. *Amantit. academ.* vol. 2 p. 371. in an express treatise on this subject the author quotes several eminent physicians both antient and modern, who maintained the same opinion as to tastes. And vol. 3. p. 183. where the assistance to be had from smell is considered, and the effects of odors amply treated on.

f Fructification. The reader perhaps may be at a loss to understand this. The meaning of it is, that plants which agree in the genus and even in the class agree also in their virtues. Thus the leaves of all the grasses are good for cattle, the lesser seeds for small birds, the greater for man, and this without exception. The stellated plants of Ray are diuretic, the rough-leaved plants of the same author are astringent and vulnerary. Plants with a pea-flower are all wholesome for cattle and man, &c. Vid. a curious treatise on this subject in the *Amantit. academ.* vol. 1. p. 389.

Ye who intend one of these days to cultivate your native soil with advantage, and profit, may be assured that you will find nothing in all the books of husbandry, that will be of such assistance to you in that art, as travelling thro' the different provinces of this kingdom. In some parts, and those the most barren, you will see very considerable crops produced by the force of skill, and industry. In others, tho' by nature extremely fertile, you will scarcely see any appearance of crops, and the inhabitants live poorly, and in miserable condition, merely from carelessness, and indolence. You may observe how far the Cuprimontani exceed all others in the management of hay, and grass, and the Gothlanders in relation to cattle, and particularly sheep.

You will have an opportunity of noting the different ways in different places of ploughing, manuring, harrowing, sowing, reaping, gathering, drying, and threshing, from whence a prudent traveller may judge which way is best.

It would be absurd indeed to apply to our lands foreign methods of husbandry in every particular, v. g. foreign grass seed would not succeed so well as our own. Yet i will venture to say one could scarcely travel a day in any of our countries without learning something of use in œconomy. Many things that will occur, may appear trifling

trifling at first sight, which yet upon a more mature consideration, you will own may be turned to very great advantage; such as the various ways of cloathing, preparing victuals, feeding cattle, not to mention the manners, commerce and numberless other particulars.

Lastly, however necessary and incumbent upon us it may be to take a view of our countrey, it will be in vain to undergo this trouble, if we do not first lay the foundation of our studies at the university, as to natural philosophy, natural, and medical history, without which preparation for travelling to advantage every thing, that occurs, will appear trite, common, and not worth our attention. The traveller however, above all men, ought to keep in mind that famous principle of Descartes, viz. to doubt about every thing. He must also be very cautious not to suffer his mind, from too eager a desire of knowledge, to be overwhelmed at the beginning by the number of things to be observed ^g. * *

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We ought to travel in the flower of our age, while the mind, and body are in vigor, while our strength is unimpaired, and alacrity at its height;

^g Here follow some few lines in the original, which not understanding i have omitted.

height; before a family, household affairs, and conjugal ties have engrossed our affections.

When by this method you have laid the first foundation of travelling in your own countrey, you will then be qualified to go farther, and become serviceable to yourselves, and the public, by learning those things abroad, which could not be learned at home; and thus, having made a fair examination, you may be enabled to judge, whether our own customs may be improved by the help of foreign ones, and how far; and thus you will not be apt rashly to imagine, that every fashion which prevails at Paris, is fit to be introduced into our cottages; lastly, thus you will not be better acquainted with the manners and custom in France, England, Germany, and other countries, than with those of your own; i. e. you will not, as the proverb says, for want of common sense,

Invert all order, and become

Lynxes abroad, mere moles at home.

But not to abuse your patience any longer, i here break off the thread of my discourse, that what time remains may be employed by me in in expressing my wishes, and thanks. First, to thee, Omnipotent God, i humbly offer up my thanksgiving, for the immense benefits, that have been heaped upon me thro' thy gracious protection, and providence. Thou from my youth

youth upwards hast so led me by the hand, hast so directed my footsteps, that i have grown up in the simplicity, and innocence of life, and in the most ardent pursuit after knowledge. I give thee thanks for that thou hast ever preserved me in all my journies thro' my native and foreign countries, amidst so many dangers, that surrounded me on every side. That in the rest of my life, amidst the heaviest burthens of poverty, and other inconveniences, thou wast always present to support me with thy almighty assistance. Lastly that amidst so many vicissitudes of fortune, to which i have been exposed, amongst all the goods, i say, and evils, the joyfull and gloomy, the pleasing, and disagreeable circumstances of life, thou endowest me with an equal, constant, manly, and superior spirit on every occasion.

To our most august, and potent prince Frederick the first, as becomes a dutifull, and obedient subject, i give most humble thanks for his favorable kindness in bestowing upon me this honorable post. May the almighty grant, that his majesty, and his most serene consort, those shining stars of the north, may long, very long illuminate, and adorn this region with the brightness of their rays.

To thee, most mighty count Gyllenbourg, illustrious chancellor of this university, to thee, tho' absent, i return the most sincere, and humble

ble thanks for the great, and even endless benefits bestowed upon me ; amongst which, exceeding all number, this must not be reckoned the least, that, when I was called hither by this academy, you recommended me in the most indulgent manner to our great monarch. It shall be my constant care that you may never repent of this favor, and by reverence, respect, and duty, to testify my gratitude to my latest breath.

To the most reverend the archbishop, to the vice-chancellor, to the magnificent rector, and to you illustrious and celebrated professors, i return also my most gratefull acknowledgments, who honoured me by your unanimous votes, and assisted in bringing me to this chair. As this your benevolence laid me under the greatest obligation to honor you, and employ every office of regard and friendship towards you, so by the grace of God i shall omit no opportunity of shewing i am not unworthy of your favor.

Whilst i am thus employed in testifying the feelings of a gratefull mind, i ought not to forget your name, most illustrious Roberg, my preceptor, and predecessor highly worthy of my utmost veneration. As i am one of those who have had the happiness of being educated in your school, i should be the most ungratefull of men, if i were ever to suffer the remembrance of such a benefit to slip out of my mind.

It

It has been your lot, venerable sir, to survive all your brethren, and you may justly boast, what every physician now in Sweden will gratefully confess, that to you, as to their faithfull instructor, they owe the beginning, the increase, and the furnishing of their art. Nay not only the faculty at Upsal, but the whole circle here present ought to salute, and reverence you as superior to them all in age.

Suffer then at last your disciple to ease you of that burthen, which for forty years, and more, you have sustained, with honor ; that now, time having laid his heavy hand upon you, you may enjoy that rest, which his sacred majesty has kindly granted to your wishes. My sincere prayers are not wanting to the almighty, that he may grant you a chearfull, and vigorous old age, and that every thing may succeed to the utmost of your desires.

Nor is it fit, ye flourishing and chosen youth, that on this solemn occasion i should pass you over in silence. I have been long sensible of your regard for me, by many, and undoubted proofs ; i have been long sensible, i say, and i gratefully acknowledge it. Many of you desired, ardently desired to have me in this station, though perhaps never seen by you before. For this alone, i know, i am called hither, that i may be usefull to you. On you therefore my fortune turns. My
industry,

industry, my studies, my labors, my watchings i willingly, and chearfully consecrate to your service, and, by the assistance of God, i will exert the utmost of my power to satisfy your expectations, that you may not be disappointed in the hopes you have conceived of me.



T H E



THE
OECONOMY of NATURE.

BY
ISAAC J. BIBERG.

Upsal, 1749. March 4.

Amænitat. Academ. vol. ii.

Æternæ sunt vices rerum. Sen. nat. 3. 1.

§ I.

BY the oeconomy of nature we understand the all-wise disposition of the creator in relation to natural things, by which they are fitted to produce general ends, and reciprocal uses.

All things contained in the compass of the
universe

universe declare, as it were, with one accord the infinite wisdom of the creator. For whatever strikes our senses, whatever is the object of our thoughts, are so contrived, that they concur to make manifest the divine glory, i. e. the ultimate end which God proposed in all his works. Whoever duly turns his attention to the things on this our terraqueous globe, must necessarily confess, that they are so connected, so chained together, that they all aim at the same end, and to this end a vast number of intermediate ends are subservient. But as the intent of this treatise will not suffer me to consider them all, i. shall at present only take notice of such as relate to the preservation of natural things. In order therefore to perpetuate the established course of nature in a continued series, the divine wisdom has thought fit, that all living creatures should constantly be employed in producing individuals, that all natural things should contribute and lend a helping hand towards preserving every species, and lastly that the death, and destruction of one thing should always be subservient to the restitution of another. It seems to me that a greater subject than this cannot be found; nor one on which laborious men may more worthily employ their industry, or men of genius their penetration.

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I am very sensible, being conscious of my own weakness, how vast and difficult a subject it is, and how unable i am to treat it as it deserves; a subject which would be too great a task for the ability of the most experienced and sagacious men, and which properly performed would furnish materials for large volumes. My design therefore is only to give a summary view of it, and to set forth to the learned world, as far as i am able, whatever curious, worthy to be known, and not obvious to every observer occurs in the triple kingdom of nature. Thus if what the industry of others shall in future times discover in this way be added to these observations, it is to be hoped, that a common stock may thence grow, and come to be of some importance. But before i examine these three kingdoms of nature, it will not, i think, be amiss to say something concerning the earth in general, and its changes.

§ 2.

The world, or the terraqueous globe, which we inhabit, is every where surrounded with elements, and contains in its superficies the three kingdoms of nature, as they are called; the fossil, which constitutes the crust of the earth, the vegetable, which adorns the face of it, and draws the greatest part of its nourishment from the fossil kingdom, and the animal, which is

sustained by the vegetable kingdom. Thus these three kingdoms cover, adorn and vary the superficies of our earth. It is not my design to make any inquiry concerning the center of the terraqueous globe. He, who likes hypotheses, may consult Descartes, Helmont, Kircher, and others. My business is to consider the external parts of it only, and whatever is obvious to the eye.

As to the strata of the earth and mountains, as far as we have hitherto been able to discover, the upper parts consist of rag-stone, the next of slate, the third of marble filled with petrifications, the fourth again of slate, and lastly the lowest of free-stone. The habitable part of the earth, though it is scooped into various inequalities, yet is every where high in comparison with the water, and the farther it is from the sea, it is generally higher. Thus the waters in the lower places are not at rest, unless some obstacle confines them, and by that means form lakes, and marshes.

The sea surrounds the continent, and takes up the greatest part of the earth's superficies, as geography informs us. Nay, that it once spread over much the greatest part, we may be convinced by its yearly decrease, by the rubbish left by the tides, by shells, strata, and other circumstances.

The

The sea shores are usually full of dead testaceous animals, wrack, and such like bodies, which are yearly thrown out of the sea. They are also covered with sand of various kinds, stones, and heaps of other things not very common. It happens moreover, that while the more rapid rivers rush through narrow vallies, they wear away the sides, and thus the friable, and soft earth falls in, and its ruins are carried to distant, and winding shores; whence it is certain, that the continent gains no small increase, as the sea subsides.

The clouds collected from exhalations, chiefly from the sea, but likewise from other waters, and moist grounds, and condensed in the lower regions of the atmosphere, supply the earth with rain; but since they are attracted by the mountainous parts of the earth, it necessarily follows, that those parts must have, as is fit, a larger share of water than the rest. Springs, which generally rush out at the foot of mountains, take their rise from this very rain water, and vapours condensed, that trickle through the holes, and interstices of loose bodies, and are received into caverns.

These afford a pure water purged by straining, which rarely dry up in summer, or freeze in winter, so that animals never want a wholesome and refreshing liquor.

The chief sources of rivers are fountains, and rills growing by gradual supplies into still larger and larger streams, till at last, after the conflux of a vast number of them, they find no stop, but falling into the sea with lessened rapidity, they there deposit the united stores they have gathered, along with forreign matter, and such earthy substances, as they tore off, in their way. Thus the water returns in a circle, whence it first drew its origin, that it may act over the same scene again.

Marshes arising from water retained in low grounds are filled with mossy tumps, which are brought down by the water from the higher parts, or are produced by putrified plants.

We often see new meadows arise from marshes dried up. This happens sooner when the * sphagnum F. S. 864. has laid a foundation; for this in process of time changes into a very porous mould, till almost the whole marsh is filled with it. After that the rush strikes root, and along with the cotton grasses constitutes a turf, raised in such a manner, that the roots get continually higher, and thus lay a more firm foundation for other plants, till the whole marsh is changed into a fine and delightfull meadow; especially if the water happens to work itself a new passage.

* A kind of moss.

Hillocks, that abound in low grounds, occasion the earth to increase yearly, more than the countryman would wish, and seem to do hurt : but in this the great industry of nature deserves to be taken notice of. For by this means the barren spots become sooner rich meadow, and pasture land. These hillocks are formed by the ant, by stones, and roots, and the trampling of cattle ; but the principal cause is the force of the winter cold, which in the spring raises the roots of plants so high above the ground, that being exposed to the air they grow, and perish ; after which the golden maiden hairs fill the vacant places.

Mountains, hills, vallies, and all the inequalities of the earth, though some think they take away much from its beauty, are so far from producing such an effect, that on the contrary they give a more pleasing aspect, as well as great advantages. For thus the terrestrial superficies is larger ; different kinds of plants thrive better, and are more easily watered, and the rain-waters run in continual streams into the sea, not to mention many other uses in relation to winds, heat and cold. Alps are the highest mountains, that reach to the second region of the air, where trees cannot grow erect. The higher these Alps are, the colder they are *ceteris paribus*. Hence the Alps in Sweden, Siberia, Swisserland,

Peru, Brasil, Armenia, Asia, Africa, are perpetually covered with snow; which becomes almost as hard as ice. But, if by chance the summer heats be greater than ordinary, some part of these stores melts, and runs through rivers into the lower regions, which by this means are much refreshed.

It is scarcely to be doubted, but that the rocks and stones dispersed over the globe were formed originally in, and from the earth; but when torrents of rain have softened, as they easily do, the soluble earth, and carried it down into the lower parts, we imagine it happens that these solid, and heavy bodies, being laid bare, stick out above the surface. We might also take notice of the wonderfull effects of the tide, such as we see happen from time to time on the sea-shore, which being daily and nightly assaulted with repeated blows, at length gives way, and breaks off. Hence we see in most places the rubbish of the sea, and shores.

The winter by its frost prepares the earth, and mould, which thence are broken into very minute particles, and thus, being put into a mouldering state, become more fit for the nourishment of plants; nay by its snow it covers the seeds, and roots of plants, and thus by cold defends them from the force of cold. I must add also that the piercing frost of the winter purifies

fies the atmosphere, and putrid waters, and makes them more wholesome for animals.

The perpetual succession of heat and cold with us renders the seasons more pleasing, and though the winter deprives us of many plants, and animals, yet the perpetual summer within the tropics is not much more agreeable, as it often destroys men, and other animals by its immoderate heat; though it must be confessed that those regions abound with most exquisite fruits. Our winters, though very troublesome to a great part of the globe, on account of their vehement, and intense cold, yet are less hurtful to the inhabitants of the northern parts, as experience testifies. Hence it happens, that we may live very conveniently on every part of the earth, as every different country has different advantages from nature.

The seasons, like every thing else, have their vicissitudes, their beginnings, their progress, and their end.

The age of man begins from the cradle, pleasing childhood succeeds, then active youth, afterwards manhood firm, severe and intent upon self-preservation, lastly old age creeps on, debilitates, and at length totally destroys our tottering bodies.

The seasons of the year proceed in the same way. Spring, the jovial, playfull infancy of all living creatures, represents childhood and youth; for then plants spread forth their luxuriant flowers, fishes exult, birds sing, every part of nature is intent upon generation. The summer, like middle age, exhibits plants, and trees every where cloathed with green; it gives vigor to animals, and plumps them up, fruits then ripen, meadows look cheerfull, every thing is full of life. On the contrary autumn is gloomy, for then the leaves of trees begin to fall, plants to wither, insects to grow torpid, and many animals to retire to their winter quarters. The day proceeds with just such steps, as the year. The morning makes every thing alert, and fit for business; the sun pours forth his ruddy rays, the flowers which had, as it were, slept all night, awake and expand themselves again; the birds with their sonorous voices, and various notes make the woods ring, meet together in flocks, and sacrifice to Venus. Noon tempts animals into the fields, and pastures; the heat puts them upon indulging their ease, and even necessity obliges them to it. Evening follows, and makes every thing more sluggish; flowers shut up,^a and

^a Of such flowers as sleep by night some account is given by Linnæus in philof. botan. p. 88. where the curious may also find p. 274. a list of plants one or other of which shut their

and animals retire to their lurking places. Thus the spring, the morning, and youth are proper for generation; the summer, noon, and manhood are proper for preservation; and autumn, evening, and old age are not unfitly likened to destruction.

§. 3.

The fossil kingdom.

Propagation.

It is agreed on all hands, that stones are not organical bodies, like plants, and animals; and therefore it is as clear that they are not produced from an egg, like the tribes of the other kingdoms. Hence the variety of fossils is proportionate to the different combinations of coalescent particles, and hence the species in the fossil kingdom are not so distinct, as in the other two. Hence also the laws of generation in relation to fossils have been in all ages extremely difficult to explain; and lastly hence have arisen so many different opinions about them, that it would be endless to enumerate them all. We therefore for the present will content ourselves with giving a very few observations on this subject.

That clay is the sediment of the sea is sufficiently proved by observation, for which reason it is

their flowers at every hour of the day without regard to the weather. One plant is so remarkable for this property, that it is generally known in our country by the name of go-to-bed-at-noon. Its botanical name is *tragopogon* or goat's beard.

gene.

generally found in great plenty along the coasts.

The journals of seamen clearly evince, that a very minute sand covers the bottom of the sea, nor can it be doubted, but that it is daily crystallised out of the water.

It is now acknowledged by all, that testaceous bodies and petrifications resembling plants were once real animals or vegetables; and it seems likely that shells being of a calcareous nature have changed the adjacent clay, sand, or mould into the same kind of substance. Hence we may be certain that marble may be generated from petrifications, and therefore it is frequently seen full of them.

Rag-stone the most common matter of our rocks appears to be formed from a sandy kind of clay, but this happens more frequently, where the earth is impregnated with iron.

Freestone is the product of sand, and the deeper the bed, where it is found, the more compact it becomes; and the more dense the sand, the more easily it concretes. But if an alkaline clay chances to be mixed with the sand, the freestone is generated more readily, as in the freestone called *cos friatilis*, *particulis argillo-glarenfis*, S. N. I. I.

I have taken the liberty not to follow the original text in this place. The learned will see the reason at first sight.

called

The flint is almost the only kind of stone; certainly the most common stone in chalky mountains. It seems therefore to be produced from chalk. Whether it can be reduced again to chalk, I leave to others to inquire.

Stratellites S. N. 33. 1. or drop-stone is composed of calcareous particles, adhering to a dry and generally a vegetable body.

The incrustations S. N. 32. 5, 6, 7, 8. are often generated, where a vitriolic water connects clayey and earthy particles together.

Slate by the vegetables, that are often included in it, seems to take its origin from a marshy mould.

Metals vary according to the nature of the matrix, in which they adhere, e. g. the pyrites cupri Fahlunensis contains frequently sulphur, arsenic, iron, copper, a little gold, vitriol, alum, sometimes lead ore, silver and zinck. Thus gold, copper, iron, zinck, arsenic, pyrites, vitriol come out of the same vein. That very rich iron ore at Normark in Vermelandia, where it was cut transversely by a vein of clay, was changed into a pure silver. The number therefore of species, and varieties of fossils, each serving for different purposes, according to their different natures, will be in proportion, as the different kinds of earths and stones are variously combined.

§. 4. Preservation.

As fossils are destitute of life, and organisation, are hard, and not obnoxious to putrefaction; so they last longer, than any other kind of bodies. How far the air contributes to this duration it is easy to perceive, since air hardens many stones upon the superficies of the earth, and makes them more solid, compact, and able to resist the injuries of time. Thus it is known from vulgar observation that lime, that has been long exposed to the air, becomes hardened. The chalky marl, which they use in Flanders for building houses, as long as it continues in the quarry, is friable; but when dug up and exposed to the air, it grows gradually harder. In the same way our old walls, and towers gain a firmness in process of time, and therefore it is a vulgar mistake, that our ancestors excelled the modern architects in the art of building as to this point, *

* Too great stress ought not, i think, to be laid on this observation of our author, though it may be in part true; for without supposing that our ancestors had more skill in building, we may suppose, what was likely to be the case, that they used more care in the choice of their materials, and had them wrought up with more labor; which must add considerably to the firmness of the cement. Where these circumstances have happened to be wanting, time alone has not been able to produce the same effect. I have seen a house about fourscore years old, where one might rub out the mortar from between the bricks without scarcely using any force.

However

However ignorant we may be of the cause, why large rocks are every where to be seen split, whence vast fragments are frequently torn off; yet this we may observe, that fissures are closed up by water, that gets between them, and is detained there; and are consolidated by crystal and spar. Hence we scarcely ever find any crystal, but in those stones, which have retained for some time in its chinks water loaded with stony particles. In the same manner crystals fill the cavities in mines, and concrete into quartz or a debased crystal.

It is manifest that stones are not only generated, augmented, and changed perpetually from incrustations brought upon moss, but are also increased by crystal, and spar. Not to mention that the adjacent earth, especially if it be impregnated with iron particles, is commonly changed into a solid stone.

It is said, that the marble quarries in Italy, from whence fragments are cut, grow up again. Ores grow by little and little, whenever the mineral particles, conveyed by the means of water through the clefts of mountains, are retained there; so that adhering to the homogeneous matter a long while, at last they take its nature, and are changed into a similar substance.

Destruction.

Fossils, although they are the hardest of bodies, yet are found subject to the laws of destruction, as well as all other created substances. For they are dissolved in various ways by the elements exerting their force upon them, as by water, air and the solar rays, as also by the rapidity of rivers, violence of cataracts, and eddies which continually beat upon and at last reduce to powder the hardest rocks. The agitations of the sea, and lakes, and the vehemence of the waves, excited by turbulent winds pulverise stones, as evidently appears by their roundness along the shore. Nay as the poet says,

The hardest stone insensibly gives way

To the soft drops, that frequent on it play.

So that we ought not to wonder, that these very hard bodies moulder away into powder, and are obnoxious like others to the consuming tooth of time.

Sand is formed of freestone, which is destroyed partly by frost, making it friable, partly by the agitation of water, and waves; which easily wear away, dissolve, and reduce into minute particles, what the frost had made friable.

Chalk is formed of rough marble, which the air, the sun, and the winds have dissolved, as appears by Iter. Goth. 170.

The

The slate earth or *humus schisti* Syf. Nat. 511. owes its origin to slate, showers, air, and snow melted.

Ochre is formed of metals dissolved, whose fæces present the very same colours, which we always find the ore tinged with, when exposed to the air. Vitriol in the same manner mixes with water from ores destroyed.

The *muria saxatilis* Syf. Nat. 14. 6. a kind of talky stone yielding salt in the parts that are turned to the sun, is dissolved into sand, which falls by little and little upon the earth, till the whole is consumed; not to mention other kinds of fossils. Lastly from these there arise new fossils as we mentioned before, so that the destruction of one thing serves for the generation of another.

Testaceous worms ought not to be passed over on this occasion, for they eat away the hardest rocks. That species of shell fish called the razor shell bores thro' stones in Italy, and hides itself within them; so that the people who eat them are obliged to break the stones, before they can come at them. The *cochlea* F. S. 1299. a kind of snail that lives on craggy rocks, eats, and bores through the chalky hills, as worms do through wood. This is made evident by the observations of the celebrated de Geer.

The vegetable kingdom.

Propagation.

Anatomy abundantly proves, that all plants are organic, and living bodies ; and that all organic bodies are propagated from an egg has been sufficiently demonstrated by the industry of the moderns. We therefore the rather, according to the opinion of the skilfull, reject the æquivocal generation of plants ; and the more so, as it is certain that every living thing is produced from an egg. Now the seeds of vegetables are called eggs ; these are different in every different plant, that the means being the same, each may multiply its species, and produce an offspring like its parent. We do not deny, that very many plants push forth from their roots fresh offsets for two or more years. Nay not a few plants may be propagated by branches, buds, suckers and leaves fixed in the ground, as likewise many trees. Hence their stems being divided into branches, may be looked on as roots above ground ; for in the same way the roots creep under ground ; and divide into branches. And there is the more reason for thinking so, because we know that a tree will grow in an inverted situation, viz. the roots being placed upwards, and the head downwards, and buried in the ground ; for then the branches will become roots, and the roots will produce

produce leaves, and flowers. The lime-tree will serve for an example, on which gardeners have chiefly made the experiment. Yet this by no means overturns the doctrine, that all vegetables are propagated by seeds; since it is clear that in each of the foregoing instances nothing vegetates but what was part of a plant, formerly produced from seed, so that, accurately speaking, without seed no new plant is produced.

Thus again plants produce seeds, but they are entirely unfit for propagation, unless fœcundation precedes, which is performed by an intercourse between different sexes, as experience testifies. Plants therefore must be provided with organs of generation; in which respect they hold an analogy with animals. Since in every plant the flower always precedes the fruit, and the fœcundated seeds visibly arise from the fruit; it is evident that the organs of generation are contained in the flower, which organs are called antheræ, and stigmata, and that the impregnation is accomplished within the flower. This impregnation is performed by means of the dust of the antheræ falling upon the moist stigmata, where the dust adheres, is burst, and sends forth a very subtle matter, which is absorbed by the style, and is conveyed down to the rudiments of the seed, and thus renders it fertile. When this operation is over, the organs of genera-

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tion

generation wither and fall, nay a change in the whole flower ensues. We must however observe, that in the vegetable kingdom one, and the same flower does not always contain the organs of generation of both sexes, but oftentimes the male organs are on one plant, and the female on another. But that the business of impregnation may go on successfully, and that no plant may be deprived of the necessary dust, the whole most elegant apparatus of the antheræ and stigmata in every flower is contrived with wonderful wisdom.

For in most flowers the stamina surround the pistills, and are of about the same height; but there are many plants, in which the pistill is longer than the stamina, and in these it is wonderful to observe, that the Creator has made the flowers recline, in order that the dust may more easily fall into the stigma. e. g. in the campanula; *primrose*, &c. But when the fecundation is compleated the flowers rise again, that the ripe seeds may not fall out before they are dispersed by the winds. In other flowers on the contrary the pistill is shorter, and there the flowers preserve an erect situation, nay when the flowering comes on they become erect; tho' before they were drooping, or immersed under water. Lastly, whenever the male flowers are placed below the female ones, the leaves are exceedingly small, and

∴ Cowslip. see page 219.

and narrow, that they may not hinder the dust from flying upwards, like smoak; as we see in the pine, fir, yew, sea-grape, juniper, cypress, &c. and when in one and the same species one plant is male, and the other female, and consequently may be far from one another, there the dust, without which there is no impregnation, is carried in abundance by the help of the wind from the male to the female; as in the whole dioicous¹ class. Again a more difficult impregnation is compensated by the longevity of the individuals, and the continuation of life by buds, suckers and roots, so that we may observe every thing most wisely disposed in this affair. Moreover we cannot without admiration observe that most flowers expand themselves when the sun shines forth, whereas when clouds, rain, or the evening comes on, they close up, lest the genital dust should be coagulated, or rendered useless, so that it cannot be conveyed to the stigmata. But what is still more remarkable and wonderfull! when the fecundation is over, the flowers neither upon showers, nor evening coming on close themselves up. Hence when rain falls in the flowering time, the husbandman and gardener foretell a scarcity of fruits. I could and would illustrate all this by

¹ i. e. where one plant bears male flowers, and the other female ones.

many remarkable instances, if the same subject had not lately been explained, in this very place in a manner equal to its importance^m. I cannot help remarking one particular more, viz. that the organs of generation, which in the animal kingdom are by nature generally removed from sight, in the vegetable are exposed to the eyes of all, and that when their nuptials are celebrated, it is wonderfull what delight they afford to the spectator by their most beautiful colors and delicious odors. At this time bees, flies, and other insects suck honey out of their nectaries, not to mention the humming bird; and that from their effete dust the bees gather wax.

§. 7.

As to the diffemination of seeds, after they come to maturity, it being absolutely necessary; since without it no crop could follow; the Author of nature has wisely provided for this affair in numberless ways. The stalks and stems favor this purpose, for these raise the fruit above the ground, that the winds, shaking them to and fro, may disperse far off the ripe seeds. Most of theⁿ pericarpiies are shut at

^m I suppose the author here alludes to a treatise published in Amæn. academ. vol. 1. entitled, *Sponsalia plantarum*, in which are contained so many proofs of the reality of the different sexes of plants, that to me there seems to remain no room for doubt.

ⁿ Whatever surrounds the seeds is called by botanical writers a pericarpium, and as we want an English word to express this, i have taken the liberty to call it a pericarp.

top, that the seeds may not fall, before they are shook out by stormy winds. Wings are given to many seeds, by the help of which they fly far from the mother plant, and oftentimes spread over a whole countrey. These wings consist either of a down, as in most of the composite-flowered plants, or of a membrane, as in the birch, alder, ash, &c. Hence woods, which happen to be consumed by fire, or any other accident, will soon be restored again by new plants, disseminated by this means. Many kinds of fruits are endued with a remarkable elasticity, by the force of which, the ripe pericarps throw the seeds to a great distance, as the wood-forrel, the spurge, the phyllanthus, the dittany. Other seeds or pericarps are rough, or provided with hooks; so that they are apt to stick to animals, that pass by them, and by this means are carried to their holes, where they are both sown, and manured by nature's wonderfull care; and therefore the plants of these seeds grow, where others will not, as hounds-tongue, agrimony, &c.

Berries and other pericarps, are by nature allotted for aliment to animals, but with this condition, that while they eat the pulp they shall sow the seeds; for when they feed upon it they either disperse them at the same time, or, if they swallow them, they are returned with interest; for they always come out unhurt. It is not

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therefore

*a plant growing in watery places
in the E. Indies - Hill: 601.*

therefore surprising, that, if a field be manured with recent mud or dung not quite rotten, various other plants, injurious to the farmer, should come up along with the grain, that is sowed. Many have believed that barley, or rye has been changed into oats, altho' all such kinds of metamorphoses are repugnant to the laws of generation, not considering that there is another cause of this phænomenon, viz. that the ground perhaps has been manured with horse-dung, in which the seeds of oats, coming entire from the horse, lye hid and produce that grain. The mistletoe always grows upon other trees, because the thrush that eats the seeds of it, casts them forth with its dung, and as bird-catchers make their bird-lime of this same plant, and daub the branches of trees with it, in order to catch the thrush, the proverb hence took its rise;

The thrush, when he besouls the bough,
Sows for himself the seeds of woe.

It is not to be doubted, but that the greatest part of the junipers also, that fill our woods, are sown by thrushes, and other birds in the same manner; as the berries, being heavy, cannot be dispersed far by the winds. The cross-bill that lives on the fir-cones, and the hawfinch that feeds on the pine-cones, at the same time sow many of their seeds, especially when they carry the cone to a stone, or trunk of a tree, that they
more

more easily strip it of its scales. Swine likewise, by turning up the earth, and moles by throwing up hillocks, prepare the ground for seeds in the same manner, as the ploughman does.

I pass over many other things, which might be mentioned concerning the sea, lakes, and rivers, by the help of which oftentimes seeds are conveyed unhurt to distant countries; nor need I mention in what a variety of other ways nature provides for the dissemination of plants, as this subject has been treated on at large in our illustrious president's oration concerning the augmentation of the habitable earth. °

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§. 10.

° As there is something very ingenious, and quite new in the treatise here referred to, I will for the sake of those, who cannot read the original, give a short abstract of it. His design is to shew that there was only one pair of all living things, created at the beginning. According to the account of Moles, says the author, we are sure, that this was the case in the human species; and by the same account we are informed that this first pair was placed in Eden, and that Adam gave names to all the animals. In order therefore that Adam might be enabled to do this, it was necessary that all the species of animals should be in paradise; which could not happen unless also all the species of vegetables had been there likewise. This he proves from the nature of their food, particularly in relation to insects, most of which live upon one plant only. Now had the world been formed in its present state, it could not have happened that all the species of animals should have been there. They must have been dispersed over all the globe, as we find they are at present, which he thinks improbable for other reasons which I shall pass over for sake of brevity. To solve all the phenomena then he lays down as a principle, that at the beginning all the earth was covered with the sea, unless one island large enough to contain all animals and vegetables. This principle he endeavor;

vor;

Preservation.

The great Author and Parent of all things, decreed, that the whole earth should be covered with plants, and that no place should be void, none barren. But since all countries have not the same changes of seasons, and every soil is not

vors to establish by several phenomena which make it probable, that the earth has been and is still gaining upon the sea, and does not forget to mention fossile shells, and plants every where found, which he says cannot be accounted for by the deluge. He then undertakes to shew how all vegetables and animals might in this island have a soil and climate proper for each, only by supposing it to be placed under the æquator, and crowned with a very high mountain. For it is well known that the same plants are found on the Swiss, the Pyrenean, the Scotch alps, on Olympus, Lebanon, Ida, as on the Lapland and Greenland alps. And Tournefort found at the bottom of mount Ararat the common plants of Armenia, a little way up those of Italy, higher those which grow about Paris, afterwards the Swedish plants, and lastly on the top the Lapland alpine plants; and i myself, adds the author, from the plants growing on the Dalecarlian alps could collect how much lower they were than the alps of Lapland. He then proceeds to shew how from one plant of each species the immense number of individuals now existing might arise. He gives some instances of the surprizing fertility of certain plants, v. g. the elecampane, one plant of which produced 3000 seeds, of spelt 2000, of the sunflower 4000, of the poppy 3200, of tobacco 40320. But supposing any annual plant producing yearly only two seeds, even of this after 20 years there would be 1,048,576 individuals. For they would increase yearly in a duple proportion, viz. 2, 4, 8, 16, 32, &c. He then gives some instances of plants brought from America, that are now become common over many parts of Europe. Lastly he enters upon the subject for which he is quoted in the text, where the detail he gives of the several methods which nature has taken to propagate vegetables is extremely curious, but too long to insert in this place.

equally

equally fit for every plant, He therefore, that no place should be without some, gave to every one of them such a nature, as might be chiefly adapted to the climate; so that some of them can bear an intense cold, others an equal degree of heat; some delight in dry ground, others in moist, &c. Hence the same plants grow only where there are the same seasons of the year, and the same soil.

The alpine plants live only in high, and cold situations, and therefore often on the alps of Armenia, Switzerland, the Pyreneans, &c. whose tops are equally covered with eternal snows, as those of the Lapland alps, plants of the same kind are found, and it would be in vain to seek for them any where else. It is remarkable in relation to the alpine plants, they they blow, and ripen their seed: very early, lest the winter should steal upon them on a sudden, and destroy them.

Our northern plants, altho' they are extremely rare every where else, yet are found in Siberia, and about Hudson's bay, as the arbutus, Flor. 339. bramble 412. winter-green, &c.

Plants impatient of cold live within the torrid zones; hence both the Indies tho' at such a distance from one another have plants in common.

The Cape of Good Hope, i know not from what cause, produces plants peculiar to itself, as all the
+ mesembryanthea, and almost all the species of
aloes. Grasses, the most common of all plants,

+ *Ficoidea*. can

can bear almost any temperature of air, in which the good providence of the Creator particularly appears ; for all over the globe they above all plants are necessary for the nourishment of cattle, and the same thing is seen in relation to our most common grains.

Thus neither the scorching sun, nor the pinching cold hinders any countrey from having its vegetables. Nor is there any soil, which does not bring forth many kinds of plants ; the pond-weeds, the water-lilly, lobelia inhabit the waters. The fluviales, fuci, conservæ cover the bottoms of rivers, and sea. The sphagna ^p fill the marshes. The brya ^q cloath the plains. The dryest woods and places scarce ever illuminated by the rays of the sun are adorned with the hypna. Nay stones and the trunks of trees are not excepted, for these are covered with various kinds of liverwort.

The desert, and most sandy places have their peculiar trees, and plants ; and as rivers or brooks are very seldom found there, we cannot without wonder observe that many of them distill water, and by that means afford the greatest comfort both to man, and beasts that travel there. Thus the ^r tillandsia, which is a parasitical plant, and grows on the tops of trees in the desarts of America, has its leaves turned at the base into the

^p Kind of moss. ^q Kind of moss. ^r Kind of mistletoe,

shape.

R. J. C. Caterby

shape of a pitcher, with the extremity expanded ; in these the rain is collected, and preserved for thirsty men, birds, and beasts.

The water-tree in Ceylon produces cylindrical bladders, covered with a lid ; into these is secreted a most pure, and refreshing water, that tastes like nectar to men, and other animals. There is a kind of cuckow-pint in New France, that if you break a branch of it, will afford you a pint of excellent water. How wise, how beautiful is the agreement between the plants of every country, and its inhabitants, and other circumstances.

§. 9.

Plants oftentimes by their very structure contribute remarkably both to their own preservation, and that of others. But the wisdom of the Creator appears no where more, than in the manner of growth of trees. For as their roots descend deeper, than those of other plants, provision is thereby made, that they shall not rob them too much of nourishment ; and what is still more, a stem not above a span in diameter often shoots up its branches very high ; these bear perhaps many thousand buds, each of which is a plant with its leaves, flowers and stipulæ. Now if all these grew upon the plain, they would take up a thousand times as much space, as the tree does, and in this case there would scarcely be room in all the earth for so many plants, as at present

present the trees alone afford. Besides plants that shoot up in this way are more easily preserved from cattle by a natural defence, and farther their leaves falling in autumn cover the
 + plants growing about against the rigor of the winter, and in the summer they afford a pleasing shade, not only to animals, but to plants against the intense heat of the sun. We may add that trees like all other vegetables imbibe the water from the earth, which water does not circulate again to the root, as the antients imagined; but being dispersed, like small rain, by the transpiration of the leaves, moistens the plants that grow about. Again many trees bear fleshy fruits of the berry or apple kind, which, being secure from the attack of cattle, grow ripe for the use of man, and other animals, while their seeds
 + are dispersed up and down after digestion. Lastly the particular structure of trees contribute very much to the propagation of insects; for these chiefly lay their eggs upon their leaves, where they are secure from the reach of cattle.

→ Ever-green trees, and shrubs with us are chiefly found in the most barren woods, that they may be a shelter to animals in the winter. They lose their leaves only every third year, as their seeds are sufficiently guarded by the mosses, and

• See Vegetable Statics by that great philosopher Dr. Hales, where this subject is treated in a masterly way.

do not want any other covering. The palms in the hot countries perpetually keep their leaves, for there the seeds stand in no need of any shelter whatever. + . .

Many plants, and shrubs are armed with thorns, e. g. the buck-thorn, floe, carduus, cotton-thistle, &c. that they may keep off the animals, which otherwise would destroy their fruit. These at the same time cover many other plants, especially of the annual kind, under their branches. So that while the adjacent grounds are robbed of all plants by the voracity of animals, some may be preserved, to ripen flowers and fruit, and stock the parts about with seeds, which otherwise would be quite extirpated.

All herbs cover the ground with their leaves, and by their shade hinder it from being totally deprived of that moisture, which is necessary to their nourishment. They are moreover an ornament to the earth, especially as leaves have a more agreeable verdure on the upper, than the under side.

The mosses, which adorn the most barren places, at the same time preserve the lesser plants, when they begin to shoot, from cold and drought.

* This observation may be extended farther ; for i have frequently seen upon commons, where furze grows, that wherever there was a bush left untouched for years by the commoners, some tree has sprung up, being secured, by the prickles of that shrub from the bite of cattle.

As we find by experience in our gardens, that plants are preserved in the same way. They also hinder the fermenting earth from forcing the roots of plants upwards in the spring; as we see happen annually to trunks of trees, and other things put into the ground. Hence very few mosses grow in the warmer climates, as not being so necessary to that end in those places.

The English sea mat-weed or marran will bear no soil but pure sand, which nature has allotted to it. Sand the produce of the sea, is blown by winds oftentimes to very remote parts, and deluges, as it were, woods and fields. But where this grass grows, it frequently fixes the sand, gathers it into hillocks, and thrives so much, that by means of this alone, at last an entire hill of sand is raised. Thus the sand is kept in bounds, other plants are preserved free from it, the ground is increased, and the sea is repelled by this wonderful disposition of nature.

How solicitous nature is about the preservation of grasses is abundantly evident from hence, that the more the leaves of the perennial grasses

^a This observation is found in Linn. Flor. Lapp. p. 62. where he says the Dutch sow this grass on their sand banks, that the sand may not overwhelm the neighbouring parts. I do not see why this experiment should not be tried on the barren sands in Norfolk about Swaffham, where I am assured by credible witnesses, that the small cottages are sometimes totally buried under sand during high winds. This grass grows plentifully along the sea shores in England. Vid. Ray, 393. 1.

are eat, the more they creep by the roots, and send forth off-sets. For the Author of nature intended, that vegetables of this kind, which have very slender, and erect leaves, should be copious, and very thick-set, covering the ground like a carpet; and thus afford food sufficient for so vast a quantity of grazing animals. But what chiefly increases our wonder is, that altho' the grasses are the principal food of such animals, yet they are forbid, as it were, to touch the flower, and seed-bearing stems; that so the seeds may ripen and be sown.

The caterpillar or grub of the moth. Faun. sue. 826. called *graelmasken*, altho' it feeds upon grasses, to the great destruction of them, in meadows, yet it seems to be formed, in order to keep a due proportion between these and other plants; for grasses, when left to grow freely, increase to that degree, that they exclude all other plants; which would consequently be extirpated, unless this insect sometimes prepared a place for them. Hence always more species of plants appear in those places, where this caterpillar has laid waste the pastures the preceding year, than at any other time.

§. 10.

Destruction.

Daily experience teaches us, that all plants, as well as all other living things, must submit to death.

They

They spring up, they grow, they flourish, they ripen their fruit, they wither, and at last, having finished their course, they die, and return to the dust again, from whence they first took their rise. Thus all black mould, which every where covers the earth, for the greatest part is owing to dead vegetables. For all roots descend into the sand by their branches, and after a plant has lost its stem the root remains ; but this too rots at last, and changes into mould. By this means this kind of earth is mixed with sand, by the contrivance of nature, nearly in the same way as dung thrown upon fields is wrought into the earth by the industry of the husbandman. The earth thus prepared offers again to plants from its bosom, what it has received from them. For when seeds are committed to the earth, they draw to themselves, accommodate to their nature, and turn into plants, the more subtile parts of this mould by the co-operation of the sun, air, clouds, rains, and winds ; so that the tallest tree is, properly speaking, nothing but mould wonderfully compounded with air, and water, and modified by a virtue communicated to a small seed by the Creator. From these plants, when they dye, just the same kind of mould is formed, as gave birth to them originally ; but in such a manner, that it is in greater quantity than before. Vegetables therefore increase the black mould, whence

whence fertility remains continually uninterrupted. Whereas the earth could not make good its annual consumption, unless it were constantly recruited by new supplies.

The crustaceous liverworts are the first foundation of vegetation, and therefore are plants of the utmost consequence in the œconomy of nature, though so despised by us. When rocks first emerge out of the sea, they are so polished by the force of the waves, that scarce any herb can find a fixed habitation upon them; as we may observe every where near the sea. But the very minute crustaceous liverworts begin soon to cover these dry rocks, although they have no other nourishment, but that small quantity of mould, and imperceptible particles, which the rain and air bring thither. These liverworts dying at last turn into a very fine earth; on this earth the * imbricated liverworts find a bed to strike their roots in. These also dye after a time, and turn to mould; and then the various kinds of mosses, e. g. the hypna, the brya, polytrica find a proper place, and nourishment. Lastly these dying in their turn, and rotting af-

* I have used this word because we have no English one of the same meaning unless it be the word scaly, that I know of. However imbricated means parts lying over parts like tiles as in the cup of the thistle flower.

ford such a plenty of new formed mould, that herbs and shrubs easily root, and live upon it.

That trees when they are dry or are cut down may not remain useless to the world, and lye, as it were, melancholy spectacles, nature hastens on their destruction in a singular way : first the liverworts begin to strike root in them ; afterwards the moisture is drawn out of them ; whence putrefaction follows. Then the mushroom kinds find a fit place for nourishment on them, and corrupt them still more. The beetle called the dermestes, next makes himself a way between the bark, and the wood. The musk-beetle, the copper talc beetle, and the caterpillar or *coffus* 812. bores an infinite number of holes through the trunk. Lastly the wood-peckers come, and while they are seeking for insects, wear away the tree, already corrupted ; till the whole passes into earth. Such industry does nature use to destroy the trunk of a tree ! Nay trees immersed in water would scarcely ever be destroyed, were it not for the worm that eats ships, which performs this work ; as the sailor knows by sad experience.

Thistles, as the most usefull of plants, are armed, and guarded by nature herself. Suppose there were a heap of clay, on which for many years no plant has sprung up ; let the seeds of
the

the thistle blow there, and grow; the thistles by their leaves attract the moisture out of the air, send it into the clay by means of their roots, will thrive themselves, and afford a shade. Let now other plants come hither, and they will soon cover the ground. St. Bielke.

All succulent plants make ground fine, of a good quality; and in great plenty, as sedum, crassula, aloë, algæ*. But dry plants make it more barren, as ling or heath, pines, moss; and therefore nature has placed the succulent plants on rocks, and the dryest hills.

§. II.

The animal kingdom.

Propagation.

The generation of animals holds the first place among all things; that raise our admiration, when we consider the works of the Creator; and chiefly that appointment, by which he has regulated the conception of the foetus, and its exclusion, that it should be adapted to the disposition, and way of living of each animal, is most worthy of our attention.

We find no species of animals exempt from the stings of love, which is put into them to the end, that the Creator's mandate may be executed, increase and multiply; and that thus the egg, in which is contained the rudiment of the

* A kind of grass wrack.

foetus, may be foecundated; for without foecundation all eggs are unfit to produce an offspring.

Foxes and wolves, struck with these stings, every where howl in the woods; crowds of dogs follow the female; bulls shew a terrible countenance, and very different from that of oxen. Stags every year have new horns, which they lose after rutting time. Birds look more beautifull than ordinary, and warble all day long through lasciviousness. Thus small birds labour to outsing one another, and cocks to out-crow. Peacocks spread forth again their gay, and glorious trains. Fishes gather together, and exult in the water; and grasshoppers chirp, and pipe, as it were, amongst the herbs. The ants gather again into colonies, and repair to their cittadels. I pass over many other particulars, which this subject affords, to avoid prolixity.

§. 12.

The foecundated egg requires a certain, and proportionate degree of heat for the expansion of the stamina of the embryo. That this may be obtained, nature operates in different manners, and therefore we find in different classes of animals a different way of excluding the foetus.

See this subject treated with great spirit in Thomson's *Spring*, and in Virgil's *Georgics*.

The

The females of quadrupeds have an uterus, contrived for easy gestation, temperate and cherishing warmth, and proper nourishment of the foetus, as most of them live upon the earth, and are there fed.

Birds, in order to get subsistence, and for other reasons, are under a necessity of shifting place; and that not upon their feet but wings. Gestation therefore would be burthenfome to them. For this reason they lay eggs, covered with a hard shell. These they sit upon by a natural instinct, and cherish till the young one comes forth.

The ostrich and cassowary are almost the only birds, that do not observe this law; these commit their eggs to the sand, where the intense heat of the sun excludes the foetus.

Fishes inhabit cold waters, and most of them have cold blood; whence it happens that they have not heat sufficient to produce the foetus. The all-wise Creator therefore has ordained, that most of them should lay their eggs upon the shore; where, by means of the solar rays, the water is warmer, and also fitter for that purpose; because it is there less impregnated with salt, and consequently milder; and also because water-insects abound more there, which afford the young fry nourishment.

Salmons in the like manner, when they are about to lay their eggs, are led by instinct to go up the stream, where the water is fresh and more pure.

The butterfly fish is an exception, for that brings forth its *foetus* alive.

The fishes of the ocean, which cannot reach the shores by reason of the distance, are also exempt from this law. The Author of nature has given to this kind eggs that swim; so that they are hatched amidst the swimming fucus, called *far-gazo*. Flor. Zeilon. 989.

The cetaceous fish have warm blood, and therefore they bring forth their young alive, and suckle them with their teats.

Many amphibious animals bring forth live *foetuses*. As the viper, and the toad, &c. But the species that lay eggs, lay them in places, where the heat of the sun supplies the warmth of the parent.

Thus the rest of the frog kind and the lizard kind, lay their eggs in warm waters; the common snake in dunghills, and such-like warm places, and give them up to nature, as a provident nurse, to take care of them. The crocodile, and sea tortoises go ashore to lay their eggs under the sand, where the heat of the sun hatches them.

Most

Most of the insect kind neither bear young nor hatch eggs; yet their tribes are the most numerous of all living creatures; insomuch that if the bulk of their bodies were proportionate to their quantity, they would scarce leave room for any other kinds of animals. Let us see therefore with what wisdom the Creator has managed about the propagation of these minute creatures. † The females by natural instinct meet and copulate with the males; and afterwards lay their eggs, but not indiscriminately in every place; for they all know how to choose such places, as may supply their offspring in its tender age with nourishment, and other things necessary to satisfy their natural wants; for the mother, soon after she has laid her eggs, dyes, and were she to live she would not have it in her power to take care of her young.

Butterflies, moths, some beetles, wevils, bugs, cuckow-spit insects, gall-insects, tree bugs, &c. lay their eggs on the leaves of plants, and every different tribe chooses its own species of plant. Nay there is scarce any plant, which does not afford nourishment to some insect; and still more, there is scarcely any part of a plant, which is not preferred by some of them. Thus one insect feeds upon the flower; another upon the trunk; another upon the root; and another upon the leaves. But we cannot help wondering

F 4 parti-

+ 600 Dorham's *Physico Theol.*
p. 209. &c

particularly, when we see how the leaves of some trees, and plants, after eggs have been let into them, grow into galls ; and form dwellings, as it were, for the young ones, where they may conveniently live. Thus when the gall-insect called cynips, Fu. 947. has fixed her eggs in the leaves of an oak, the wound of the leaf swells, and a knob like an apple arises, which includes and nourishes the embryo.

When the tree-bug, Faun. Suec. 700. has deposited its eggs in the boughs of the fir tree, excrescences arise shaped like pearls. When another species of the tree-bug, Fu. 695. has deposited its eggs in the mouse-ear chickweed or the speedwell, Fl. 12. the leaves contract in a wonderful manner into the shape of a head. The water spider, Fu. 1150. excludes its eggs either on the extremities of the juniper, which from thence forms a lodging, that looks like the arrow-headed grass, or on the leaves of the poplar, from whence a red globe is produced. The tree-louse, Fu. 1355. lays its eggs on the leaves of the black poplar, Fl. 821. which upon that turn into a kind of inflated bag, and so in other instances. Nor is it upon plants only that insects live, and lay their eggs. The knats, Fu. 1116. commit theirs to stagnating waters. The water insect called mon-
oculus,

oculus, Fu. 1182. often increases so immensely on pools, that the red legions of them have the appearance of blood. Others lay their eggs in other places, e. g. the beetle in dunghills. The dermestes in skins. The flesh fly in putrified flesh. The cheese-maggot in the cracks of cheese, from whence the caterpillars issuing forth oftentimes consume the whole cheese, and deceive many people, who fancy the worms are produced from the particles of the cheese itself, by a generation called æquivocal, which is extremely absurd. Others exclude their eggs upon certain animals. The mill-beetle lays its eggs between the scales of fishes. The species of gad-fly on the back of cattle. The species 1025 on the back of the rein deer. The species 1026 in the noses of sheep. The species 1028 lodges during the winter in the intestinal tube, or the throat of horses, nor can it be driven out till the summer comes on. Nay insects themselves are often surrounded with the eggs of other insects, insomuch that there is scarcely an animal to be found, which does not feed its proper insect, nor to say any more of all the other places, where they deposit their eggs. Almost all the eggs of insects, when laid, are ordained to undergo, by a wonderfull law of nature, various metamorphoses, e. g. the egg of the butterfly being laid in the cabbage first of all becomes a caterpillar,

pillar, that feeds upon grass, crawls, and has sixteen feet. This afterwards changes into a nymph, that has no feet, is smooth, and eats nothing; and lastly this bursts into a butterfly, that flies, has variety of colours, is rough, and lives upon honey. What can be more worthy of admiration, than that one, and the same animal should appear on the stage of life under so many characters, as if it were three distinct animals².

The laws of generation of worms are still very obscure, as we find they are sometimes produced by eggs, sometimes by offsets, just in the same manner as happens to trees. It has been observed with the greatest admiration, that the polypus or hydra S. N. 221. lets down shoots and live branches, by which it is multiplied. Nay more, if it be cut into many parts, each segment, put into the water, grows into a perfect animal; so that the parts which were torn off are restored from one scrap.

§. 13.

The multiplication of animals is not tyed down to the same rules in all; for some have a

² Linnaeus Amæn. academ. vol. 2. in a treatise on the wonders relating to insects, says, "as surprising as these transformations may seem, yet much the same happens when a chicken is hatched, the only difference is, that the chicken breaks all three coats at once, the butterfly one after another.

remark.

remarkable power of propagating, others are confined within narrower limits in this respect. Yet in general, we find, that nature observes this order, that the least animals, and those which are usefull, and serve for nourishment to the greatest number of other animals, are endued with a greater power of propagating than others*.

Mites, and many other insects will multiply to a thousand within the compass of a very few days. While the elephant scarcely produces one young in two years.

The hawk kind generally lay not above two eggs, at most four, while the poultry kind rise to 50.

The diver or loon, which is eaten by few animals lays also two eggs, but the duck kind, the moor game, partridges, &c. and small birds lay a very large number.

If you suppose two pigeons to hatch nine times a year, they may produce in four years 14762 young*. They are endued with this remarkable fertility, that they may serve for food,

* Herodotus speaking of the flying serpents in Arabia makes the same reflection, and attributes this course of nature to the divine providence. Thal.

* I have given this passage as it stands in the original. The numbers ought to have been 14760, or the expression should have been altered; for he includes the first pair.

He supposes it generally known that pigeons hatch but two eggs at a time, and that they pair.

not only to man, but to hawks, and other birds of prey. Nature has made harmless and esculent animals fruitfull. Plin. Nature has forbid the bird kind to fall short of the number of eggs allotted to each species, and therefore if the eggs which they intend to sit upon, be taken away a certain number of times, they presently lay others in their room, as may be seen in the swallow, duck, and small birds.

§. 14.

Preservation.

Preservation follows generation; this appears chiefly in the tender age, while the young are unable to provide for their own support. For then the parents, though otherwise ever so fierce in their disposition, are affected with a wonderful tenderness or sense of love towards their progeny, and spare no pains to provide for, guard, and preserve them, and that not by an imaginary law, but one given by the Lord of nature himself.

Quadrupeds give suck to their tender young, and support them by a liquor, perfectly easy of digestion, till their stomachs are able to digest, and their teeth are fit to chew more solid food. Nay their love toward them is so great, that they endeavor to repell with the utmost force every thing, which threatens danger, or destruction to them. The ew which brings forth two lambs at a time, will not admit one to her teats,

teats, unless the other be present, and suck also; lest one should famish, while the other grows fat.

Birds build their nests in the most artificial manner, and line them as soft as possible, for fear the eggs should get any damage. Nor do they build promiscuously in any place; but there only, where they may quietly lye concealed and be safe from the attacks of their enemies.

The hanging bird, Act. Bonon. vol. 2. makes its nest of the fibres of withered plants, and the down of the poplar seeds, and fixes it upon the bough of some tree hanging over the water; that it may be out of reach.

The diver, Fu. 123. places its swimming nest upon the water itself amongst the rushes. I designedly pass over many other instances of the like kind.

Again birds sit on their eggs with so much patience, that many of them choose to perish with hunger, rather than expose the eggs to danger by going to seek for food.

The male rooks and crows at the time of incubation bring food to the females.

Pigeons, small birds, and other birds, which pair, sit by turns; but where polygamy prevails, the males scarcely take any care of the young.

Most of the duck kind pluck off their feathers in great quantity, and cover their eggs with

with them, lest they should be damaged by the cold, when they quit their nests for the sake of food; and when the young are hatched, who knows not how solicitous they are in providing for them, till they are able to fly, and shift for themselves?

Young pigeons would not be able to make use of hard seeds for nourishment, unless the parents were to prepare them in their crops, and thence feed them.

The owl called the eagle owl makes its nest on the highest precipices of mountains, and in the warmest spot, facing the sun; that the dead bodies brought there may by the heat melt into a soft pulp, and become fit nourishment for the young.

The cuckow lays its eggs in the nest of other small birds, generally the wag-tail^c or^d hedge-

^c This custom of the cuckow is so extraordinary, and out of the common course of nature, that it would not be credible, were it not for the testimony of the most knowing and curious natural historians, such as Ray, Willughby, Gesner, Aldrovandus, Aristotle, &c. To say the truth i do not see how this account has a place here, where the subject is about the care, which animals have of their young. It would better, i think, serve as an instance of the contrary. What the meaning of this want of common instinct can be, i pretend not to guess, but i do not doubt but that it has a meaning.

Much has been said by the writers on birds about the fate of the young birds, in whose nest the cuckow is hatched, but as i find nothing but mere conjecture, it would not be worth while transcribing.

^d Hedge sparrow. Linnaeus seems to have taken the white-throat for the hedge-sparrow.

sparrow,

sparrow, and leaves the incubation, and preservation of the young to them. But that these young, when grown up, degenerate into hawks, and become so ungratefull, that they destroy their nurses, is a mere vulgar error, for it is contrary to their nature to eat flesh.

Amphibious animals, fishes and insects, which cannot come under the care of their parents, yet owe this to them, that they are put in places, where they easily find nourishment, as we have observed.

§. 15.

As soon as animals come to maturity, and want no longer the care of their parents, they attend with the utmost labor, and industry, according to the law and œconomy appointed for every species, to the preservation of their lives. But that so great a number of them, which occur every where, may be supported, and a certain and fixed order may be kept up amongst them, behold the wonderfull disposition of the Creator, in assigning to each species certain kinds of food, and in putting limits to their appetites. So that some live on particular species of plants, which particular regions, and soils only produce. Some on particular animalcula, others on carcasses, and some even on mud and dung. For this reason Providence has ordained, that some should swim in certain regions of the watery element,

element, others should fly ; some should inhabit the torrid, the frigid, or the temperate zones, and others should frequent deserts, mountains, woods, pools or meadows, according as the food proper to their nature is found in sufficient quantity. By this means there is no terrestrial tract, no sea, no river, no countrey, but what contains, and nourishes various kinds of animals. Hence also an animal of one kind cannot rob those of another kind of its aliment ; which, if it happened, would endanger their lives or health ; and thus the world at all times affords nourishment to so many, and so large inhabitants, at the same time that nothing, which it produces, is useless or superfluous.

I think it will not be amiss to produce some instances, by which it will appear, how providentially the Creator has furnished every animal with such cloathing, as is proper for the countrey where they live, and also how excellently the structure of their bodies is adapted to their particular way of life ; so that they seem to be destined solely to the places, where they are found.

Monkies, elephants, and rhinoceros's feed upon vegetables, that grow in hot countries, and therefore therein they have their allotted places. When the sun darts forth its most fervid rays, these animals are of such a nature, and disposition, that it does them no manner of hurt ; nay
with

with the rest of the inhabitants of those parts they go naked, whereas where they covered with hairy skins they must perish with heat.

On the contrary the place of rein deer is fixed in the coldest part of Lapland, because their chief food is the liverwort, Fl. 980. which grows no where so abundantly as there; and where, as the cold is most intense, the rein deer are cloathed, like the other northern animals, with skins filled with the densest hair; by the help of which they easily defy the keenness of the winter. In like manner the rough-legged partridge passes its life in the very Lapland alps, feeding upon the seeds of the dwarf birch, and that they may run up and down safely amidst the snow, their feet are feathered.

The camel frequents the sandy, and burning deserts, in order to get the barren camel's hay. How wisely has the Creator contrived for him! he is obliged to go thro' the deserts, where oftentimes no water is found for many miles about. All other animals would perish with thirst in such a journey; but the camel can undergo it without suffering; for his belly is full of cells, where he reserves water for many days. It is reported by travellers, that the Arabians, when in travelling they want water, are forced to kill their camels, and take water out of their bellies, that is perfectly good to drink, and not at all corrupted.

The pelican likewise lives in desert, and dry places ; and is obliged to build her nest far from the sea, in order to procure a greater share of heat to her eggs. She is therefore forced to bring water from afar for herself and her young ; for which reason Providence has furnished her with an instrument most adapted to this purpose ; v. g. she has a very large bag under her throat, which she fills with a quantity of water sufficient for many days ; and this she pours into the nest to refresh her young, and teach them to swim.

The wild beasts, lions, and tigers, come to this nest to quench their thirst, but do no hurt to the young.

Oxen delight in low grounds, because there the food most palatable to them grows.

Sheep prefer naked hills, where they find a particular kind of grass called the festuca, Fl. 95. which they love above all things.

Goats climb up the precipices of mountains, that they may browse on the tender shrubs, and in order to fit them for it, they have feet made for jumping.

Horses chiefly resort to woods, and feed upon leafy plants.

Nay, so various is the appetite of animals, that there is scarcely any plant, which is not chosen by some, and left untouched by others. The
horse

horse gives up the water hemlock to the goat. The cow gives up the long-leaved water hemlock to the sheep. The goat gives up the monks-hood to the horse, &c. for that which certain animals grow fat upon, others abhor as poison. Hence no plant is absolutely poisonous, but only respectively. Thus the spurge, that is noxious to man, is a most wholesome nourishment to the caterpillar, Fu. 825. That animals may not destroy themselves for want of knowing this law, each of them is guarded by such a delicacy of taste and smell, that they can easily distinguish what is pernicious from what is wholesome; and when it happens that different animals live upon the same plants, still one kind always leaves something for the other, as the mouths of all are not equally adapted to lay hold of the grass; by which means there is sufficient food for all. To this may be referred an oeconomical experiment well known to the Dutch, that when eight cows have been in a pasture, and can no longer get nourishment, two horses will do very well there for some days, and when nothing is left for the horses, four sheep will live upon it.

Swine get provision by turning up the earth; for there they find the succulent roots, which to them are very delicious.

The leaves and fruits of trees are intended as

food for some animals, as the sloth*, the squirrel, and these last have feet given them fit for climbing.

Besides

e There is so curious an account of this animal in Kircher's *Musurgia*, that i think the reader will excuse my transcribing it. That author says thus : ' The description of this animal i had from father Torus, who resided in America, who had animals of this kind in his possession, and made many experiments in relation to their nature and qualities. Its figure is extraordinary ; it is about the bigness of a cat, of very ugly countenance, and has claws extended like fingers. The hinder part of the head and neck are covered with hair. It sweeps the ground with its fat belly, never rises upon its feet, and moves so slowly, that it would scarce go the length of a bow-shot in 15 days, tho' constantly moving, and it is therefore called the Sloth. It is not known what it feeds upon, not being ever observed to take any food. It lives generally upon tops of trees, and employs two days to crawl up, and as many to get down again. Nature has doubly guarded this animal against its enemies. First by giving it such strength in its feet that whatever it seizes, it holds so fast, that it never can be freed from its claws, but must there dye of hunger. Secondly in giving it such a moving aspect, when it looks at any man who should be tempted to hurt it, that it is impossible not to be touched with compassion ; besides that at the same time it sheds tears, and upon the whole persuades one, that a creature so defenceless, and of so unhappy a body ought not to be tormented. To make an experiment of this, the above-mentioned father procured one of these animals to be brought to our college at Carthagenæ. He put a long pole under its feet, which it seized upon very firmly, and would not let go again. The animal therefore thus voluntarily suspended was placed between two beams along with the pole, and there it remained without meat, drink, or sleep, forty days ; its eyes being always fixed on people that looked at it, who were so touched, that they could not forbear pitying it. At last being taken down they let loose a dog on it, which after a little while the Sloth seiz'd with his feet, and held him four days, till he dyed of hunger. This was taken from the mouth of the father. They add, continues Kircher, that this

Besides myriads of fishes, the castor, the sea-calf, and others inhabit the water, that they may there be fed, and their hinder feet are fit for swimming, and perfectly adapted to their manner of life.

The whole order of the goose kind, as ducks, merganser, &c. pass their lives in water, as feeding upon water-insects, fishes, and their eggs.. Who does not see, that attends ever so little, how exactly the wonderfull formation of their beaks, their necks, their feet, and their feathers suits their kind of life, which observation ought to be extended to all other birds.

The way of living of the sea-swallow deserves to be particularly taken notice of; for as he

this creature makes no noise but at night, but that very extraordinary. For by interruptions, that last about the length of a sigh or semipause it goes thro' the six vulgar intervals of music ut, re, mi, fa, sol, la. La, sol, fa, mi, re ut, ascending and descending, and these perfectly in tune. So that the Spaniards, when they first got possession of this coast, and heard these notes, they imagined that some people brought up to our music, were singing. This animal is called by the natives Haut, certainly because going thro' these musical intervals, it repeats Ha, ha, ha, ha, ha, &c.

This account seems very wonderfull, and i leave it as it stands without entering into any discussion about its credibility. I will only add, that Linnæus seems in the new edition of the Syst. Nat. to give credit to it. For he says in his short way of description among other things, 'It utters an ascending hexacord. Its noise is horrible, its tears piteous.' He quotes Mangrove, Clusius, Gesner, &c. But not having an opportunity of consulting these books i cannot tell how far these authors confirm the foregoing account; if it be true, it would furnish some observations, but this would not be a place for them.

G 3

cannot



100 pag, 219,

cannot so commodiously plunge into the water, and catch fish, as other aquatic birds, the Creator has appointed the sea-gull to be his caterer in the following manner. When this last is pursued by the former, he is forced to throw up part of his prey, which the other catches; but in the autumn, when the fishes hide themselves in deep places, the merganser, Fu. 113. supplies the gull with food, as being able to plunge deeper into the sea. Act. Stock. The chief granary of small birds is the knot-grass, Fol. Suec. 322. that bears heavy seeds, like those of the black bindweed. It is a very common plant, not easily destroyed, either by the road side by trampling upon it, or any where else, and is extremely plentiful after harvest in fields, to which it gives a reddish hue by its numerous seeds. These fall upon the ground, and are gathered all the year round by the small birds*. Thus bountifull nature feeds the fowls of the air.

The Creator has taken no less care of some amphibious animals, as the snake, and frog kind, which, as they have neither wings to fly, nor feet to run swiftly, and commodiously,

* To which we may add, that many small birds feed upon the seeds of plantain, particularly linnets. It is generally known that the goldfinch lives upon the seed of thistles, from which he has its name in Latin and French.

would

would scarcely have any means of taking their prey, were it not that some animals run, as it were of their own accord, into their mouths. When the rattle-snake a native of America, with open jaws fixes his eyes on a bird, fly, or squirrel, sitting on a tree, they fly down his throat, being rendered stupid, and giving themselves up, ^f as destitute of all refuge. On the other hand we cannot but adore the Creator's great goodness towards man, when we consider the rattle which terminates this serpent's tail. For by means of that we have an opportunity of guarding against this dreadful enemy; the sound warning us to fly, which if we were not to do, and we should be wounded by him, the whole body would be turned into a putrid corruption in six hours, nay sometimes in half an hour.  

The limits of this dissertation will not permit me to produce more examples of this kind. But whoever will be at the pains to take ever so slight a view of the wonderfull works of the Creator, will readily see, how wisely the plan, order and fitness of things with divine ends are disposed.

^f How dreadful this serpent is to other animals will appear by an account we have in a treatise intitled, *Radix Senega*. Where the author *Amæn. academ. vol. 2.* says, one of these terrible serpents got clandestinely into the house of governor Blake at Cacolina; where it would have long laid concealed, had it not been that all the domestic animals, as dogs, hogs, turkies and fowls admonished the family by their unusual cries, equally shewing their horror and consternation, their hair, bristles and crests standing up an end.

We cannot without the utmost admiration behold how providently the Creator has acted as to the preservation of those animals, which at a certain time of the year, are by the rigor of the season excluded from the necessaries of life. Thus the bear in the autumn creeps into the moss, which he has gathered, and there lies all winter; subsisting upon no other nourishment but his fat, collected during the summer in the cellulous membrane, and which without doubt, during his fast, circulates thro' his vessels, and supplies the place of food; to which perhaps is added that fat juice which he sucks out of the bottom of his feet. *L*

The hedge-hog, badger and mole in the same manner fill their winter quarters with vegetables, and sleep during the frosts. The bat seems cold, and quite dead all the winter. Most of the amphibious animals get into dens, or to the bottom of lakes and pools. *Enge*

In the autumn, as the cold approaches, and insects disappear, swallows seek for an asylum against the violence of the cold in the bottom of

g I never had but one credible testimony that swallows pass the winter at the bottom of lakes or ponds; and this from a gentleman of character, who saw a swallow so found brought to life by warmth. On the other hand, I know of no author but Herodotus who mentions their being seen in any country during the winter, and he, as well as I remember, for I cannot find the place, affirms that of Arabia.

See page - 220.

lakes

lakes amongst the reeds and rushes; from whence by the wonderfull appointment of nature they come forth again. The peristaltic motion of the bowels ceases in all these animals, while they are obliged to fast, whence the appetite is diminished, and so they suffer less from hunger. To this head may be referred the observation of the celebrated Lister concerning those animals; that their blood, when let into a basin, does not coagulate, as that of all other animals, and so is no less fit for circulation than before. 2

The moor-fowls work themselves out walks under the very snow. They moult in the summer, so that about the month of August they cannot fly, and are therefore obliged to run into the woods; but then the moor-berries and bilberries are ripe, from whence they are abundantly supplied with food. Whereas the young do not moult the first summer, and therefore, tho' they cannot run so well, are able to escape danger by flight.

The rest of the birds who feed upon insects migrate every year to forreign regions, in order to seek for food in a milder climate; while all the northern parts, where they live well in the summer, are covered with snow.

Insects in the winter generally lye hid within their cases, and are nourished by the surrounding liquor like the foetus of other animals, from whence

whence at the approach of spring they awake, and fly forth to the astonishment of every one.

However all animals, which lye hid in winter, do not observe these laws of fasting. Some provide store-houses in summer, and autumn, from which they take what is necessary, as mice, jays, squirrels, bees.

What i have observed in a few words concerning the migration of birds into forreign countries, gives me an opportunity of illustrating this subject farther by instances.

The starling, finding with us after the middle of summer worms in less plenty, yearly goes into Scania, Germany and Denmark.

The female chaffinches every winter about Michaelmas go in flocks to Holland; but as the males stay with us, they come back the next spring, unless such as choose to breed no more. In the same manner the female Carolina yellow-hammer in the month of September, while the rice, on which she feeds, is laid up in granaries, goes towards the south, and returns in the spring to seek her mate. Our aquatic birds are forced by necessity to fly towards the south every autumn before the water is frozen. Thus we know that the lakes of Poland and Lithuania are filled with swans and geese every autumn, at which time they go in great flocks along many rivers as far as the Euxine. But in the beginning

+ Both Birds have been seen
common in the winter & killed -
the hen rather more frequently.

ning of spring, as soon as the heat of the sun molts them, they turn back, and go again to the northern pools, and lakes, in order to lay their eggs. For there, and especially in Lapland, there is a vast abundance of knats which afford them excellent nourishment, as all of this kind live in the water, before they get their wings.

The woodcock lives in England in winter, and departs from thence at the coming on of spring after they have paired.

The swallow-tail'd sheldrake crosses Sweden in April, and does not stop till she has reached the White sea.

The coblers awl goes every autumn into Italy.

The arctic diver goes into Germany every spring, and autumn. *Puffin* The Puffin.

The missel thrush fills our woods in the spring, but leaves us in the winter.

The pied chaffinch during the winter, being obliged to leave the alps, hastens into Sweden, and often into Germany.

The gulls visit Spain and Italy.

The raven ^h goes into Scania.

By these migrations birds also become useful to many different countries, and are distributed

^h I have translated the word *corvus* by raven, because Linnaeus does not mention the carrion crow at all, either in the Faun. Suec. nor in the Syst. Nat. before the late edition.

over almost all the globe. I cannot forbear expressing my admiration here, that all of them exactly observe the times of coming and going, and that they do not mistake their way.

There is a very large shell-fish in the Mediterranean called the pinna, blind as all of that genus, but furnished with very strong calcareous valves. (Bell. aquat. 401. t. 401. Jonst. exsang. t. 16. f. 5, 6. Gualt. ind. t. 79, 79). The scuttle-fish (Bell. aquat. 330 t. 331. Jonst. exsang. t. 1. f. 1.) is an inhabitant of the same sea, and a deadly enemy to the former; as soon as the scuttle-fish sees the pinna open its shell, he rushes upon her like a lion, and devours her. The pinnoteris or pinnophylax (Jonst. exsang. t. 20. f. 3.) is of the crab kind naked, like the hermit, and very quick-sighted. This cancer or crab the pinna receives into her covering, and when she opens her valves in quest of food, lets him out to look for prey. During this the scuttle-fish approaches; the crab returns with the utmost speed and anxiety to his hostess, who being thus warned of the danger shuts her doors, and keeps out the enemy. That very sagacious observer D. D. Hasselquist in his voyage towards Palestine beheld this curious phænomenon, which tho' well known to the antients had escaped the moderns. Arist. hist. lib. 5. c. 15. relates, that the pinna kept a guard to watch for her. That there
grew

grew to the mouth of the pinna a small animal, having claws, and serving as a caterer, which was like a crab, and was called the pinnophylax.

Plin. 9. 51. says, the smallest of all the kinds is called the pinnoteres, and therefore liable to injury; this has the prudence to hide itself in the shells of oysters. Plin. 9. 66. ⁱ The pinna is of the genus of shell-fish; it is produced in muddy waters, always erect, nor ever without a companion, which some call the pinnoteres, others the pinnophylax. This sometimes is a small squill, sometimes a crab, that follows the pinna for the sake of food. The pinna is blind, and when upon opening its shell it exposes itself as a prey to the smallest kind of fishes, these immediately assault her, and growing bolder upon finding no resistance venture in. The guard watching its time gives notice by a bite, upon which the pinna closing its shell, shuts in, kills, and gives

ⁱ This is taken out of Aristotle, who seems to have thought, that the pinna grew from that which really is its beard, and which it throws out upon the adjoining bodies in order to fix itself. For he says the pinna is produced from the byssus, which is generally supposed to mean the beard of this shell-fish, and to have been used for making the finest of stuffs, frequently mentioned by antient writers under the name of Byssine garments, and of which they now in some countries make stockings, as I am informed. This notion of the pinna growing from the byssus or beard is of the same kind with that which prevailed formerly in relation to the goose tree, mentioned by many writers, of whom a long list may be seen in the last edition of the Syst. Nat.

*See the Pinna described
in Martyn's memoirs.*

part

part of whatever happens to be there to its companion.

The pinna, and the crab together dwell;
For mutual succour in one common shell.
They both to gain a livelihood combine
That takes the prey, when this has given the sign.
From hence this crab above his fellows famed
By antient Greeks was pinnoteris named.

OPPIAN.

§. 18.

Destruction.

We have observed above, that all animals do live upon vegetables, but that there are some which feed upon certain animalcula. Nay there are some which subsist only by rapine, and daily destroy numbers of the peaceable kind.

These animals are destroyed, but in such a manner that the weaker generally are infested by the stronger in a continued series. Thus the tree-louse lives upon plants. The fly called musca aphidivora lives upon the tree-louse. The hornet and wasp fly upon the musca aphidivora. The dragon fly upon the hornet and wasp fly. The spider on the dragon fly. The small birds on the spider. And lastly the hawk kind on the small birds.

In like manner the ^k monocolus delights in putrid waters, the knat eats the monocolus, the frog eats the knat, the pike eats the frog, the sea calf eats the pike.

The bat and goat-sucker make their excursions only at night, that they may catch the moths which at that time fly about in vast quantities.

The wood-pecker pulls out the insects, which lye hid in the trunks of trees.

The swallow pursues those which fly about in the open air.

The mole pursues worms. The large fishes devour the small. Nay we scarcely know an animal, which has not some enemy to contend with.

Amongst quadrupeds wild beasts are most remarkably pernicious and dangerous to others, as the hawk kind among birds. But that they may not, by too atrocious a butchery, destroy whole species; even these are circumscribed within certain bounds. First, as to the most fierce of all, it deserves to be noted how few they are in proportion to other animals. Secondly, the number of them is not equal in all countries. Thus France and England breed no wolves, and the northern countries no tigers or lions. Thirdly, these fierce animals sometimes

^k An insect that has no name in English as far as i can find.

fall upon, and destroy one another. Thus the wolf devours the fox. The dog infests both the wolf and fox; nay wolves in a body will sometimes venture to surround a bear. The tiger often kills its own male whelps. Dogs are sometimes seized with madness and destroy their fellows, or with the mange destroy themselves.

Lastly, wild beasts seldom arrive at so great an age as animals, which live on vegetables. For they are subject from their alkaline diet to various diseases, which bring them sooner to an end.

But although all animals are infested by their peculiar enemies, yet they are often able to elude their violence by stratagems and force. Thus the hare often confounds the dog by her windings.

When the bear attacks sheep and cattle, they draw up together for mutual defence. Horses joyn heads together, and fight with their heels. Oxen joyn tails, and fight with their horns.

Swine get together in herds, and boldly oppose themselves to any attack, so that they are not easily overcome; and it is worth while to observe, that all of them place their young, as less able to defend themselves, in the middle, that they may remain safe during the battle.

Birds

Birds by their different ways of flying often-times escape the hawk. If the pigeon had the same way of flying as the hawk, she would hardly ever escape his claws.

As I have, when opportunities offered, measured and weighed several kinds of birds, I shall here subjoin a table of some of them with the proportions of the weight to the sail. N. B. By sail I mean the extent of the wings and tail. I do not pretend to accuracy, and I imagine it will not be expected on a subject of this nature.

	Weight Avoirdupois.	Proportion of square inches to the ounce.
	l. oz.	
Turkey	8 8	2 $\frac{1}{4}$
Pheasant	2 8	2 $\frac{1}{2}$
Coot	2 8	2 $\frac{1}{4}$
Black cock	2 6	3 $\frac{1}{2}$
Puttock	1 14	18
Rook	1 3	10 $\frac{1}{2}$
Partridge	1 1	3
Ivy owl	0 15	9
Ring-dove	0 14	10
Woodcock	0 10	6
Small hawk	0 6 $\frac{1}{4}$	26
Wood-pecker	0 4	9
Cuckow	0 4	18
Mistle bird	0 4	14
Snipe	0 4	9 $\frac{1}{2}$
Redshank	0 4	9
Cross bill	0 1 $\frac{1}{2}$	11 $\frac{1}{2}$
House swallow	0 1	18
House sparrow	0 1	12
Wheat-ear	0 1	14
Linnet	0 0 $\frac{1}{2}$	20 $\frac{1}{2}$
Black cap	0 0 $\frac{1}{2}$	18
Stone smich	0 0 $\frac{1}{2}$	25
Beccafigo	0 0 $\frac{1}{2}$	24
White throat	0 0 $\frac{1}{2}$	17
	grains.	
Long tailed titmouse	0 95	25
Regulus cristatus	0 76	23

It deserves also to be remarked, how much some animals consult their safety by night. When horses sleep in woods, one by turn remains awake, and, as it were, keeps watch. When monkies, S. N. 2. 10. in Brasil sleep upon trees, one of them keeps awake, in order to give the sign, when the tiger creeps towards them, and in case the guard should be caught asleep, the rest tear him to pieces. Hence the hunting of rapacious animals is not always successful, and they are often obliged to labor for a whole day to no purpose. For this reason the Creator has given them such a nature, that they can bear fasting a long time. Thus the lion

It appears by this table that the smaller birds in general have more sail in proportion than the larger of the esculent kind, such as the pheasant, partridge, woodcock, ring-dove, &c. and that it should be so contrived appears reasonable on more accounts than one. First, because small birds living, many of them, amongst shrubs and bushes, are obliged to make short and quick motions in hopping from bough to bough, at which time they always make use of their wings; some of them live chiefly on worms and flies, which are not to be caught without great nimbleness, and frequent gardens and houses and are more liable to the attacks of cats and other animals. And those which live in the open fields are exposed to the hawk, and were they not quick at turning they would scarcely ever escape.

Again the different proportions of the bulk to the surface in large and small birds is to the disadvantage of the latter, on account of the greater proportional resistance of the air, and this wanted some compensation.

More might be added on this subject, but I am afraid most readers will think what I have already said is more than enough.

lurks

lurks in his den many days without famishing, and the wolf, when he has once well satisfied his hunger, can fast many weeks without any difficulty.

If we consider the end for which it pleased the Supreme Being to constitute such an order of nature, that some animals should be, as it were, created only to be miserably butchered by others, it seems that his Providence not only aimed at sustaining, but also keeping a just proportion amongst all the species; and so prevent any one of them from increasing too much, to the detriment of men, and other animals. For if it be true, as it is most assuredly, that the surface of the earth can support only a certain number of inhabitants, they must all perish, if the same number were doubled, or tripled, Derh. Phys. Theol. p. 237.

There are some viviparous flies, which bring forth 2000 young. These in a little time would fill the air, and like clouds intercept the rays of the sun, unless they were devoured by birds, spiders, and many other animals.

Storks, and falcons free Ægypt from frogs, which after the inundation of the Nile, cover all the countrey. The same birds also clear Palestine of mice. Bellonius on this subject says as follows. "The storks come to Ægypt in such abundance, that the fields, and mea-

"dows are white with them. Yet the Ægypt-
 "tians are not displeased with this sight; as
 "frogs are generated in such numbers there,
 "that did not the storks devour them, they
 "would over-run every thing. Besides they
 "also catch, and eat serpents. Between Belba
 "and Gaza the fields of Palestine are often de-
 "sert on account of the abundance of mice, and
 "rats; and were they not destroyed by the fal-
 "cons, that come here, by instinct, the inha-
 "bitants could have no harvest.

The white fox is of equal advantage in the
 Lapland alps; as he destroys the Norway rats,
 which are generated there in great abundance,
 and thus hinders them from increasing too much
 in proportion, which would be the destruction of
 vegetables.

It is sufficient for us, that nothing is made
 by Providence in vain, and that whatever is
 made, is made with supreme wisdom. For it
 does not become us to pry too boldly into all the
 designs of God. Let us not imagine, when
 these rapacious animals sometimes do us mis-
 chief, that the Creator planned the order of na-
 ture according to our private principles of œco-
 nomy; for the Laplanders have one way of
 living; the European husbandman another;
 the Hottentots and savages a third, whereas the

the stupendous œconomy of the Deity is one throughout the globe, and if Providence does not always calculate exactly according to our way of reckoning, we ought to consider this affair in the same light, as when different seamen wait for a fair wind, every one, with respect to the part he is bound to, who we plainly see cannot all be satisfied.

§. 19.

The whole earth would be overwhelmed with carcases, and stinking bodies, if some animals did not delight to feed upon them. Therefore when an animal dyes, bears, wolves, foxes, ravens, &c. do not lose a moment till they have taken all away. But if a horse e. g. dyes near the public road, you will find him, after a few days, swollen, burst, and at last filled with innumerable grubs of carnivorous flies, by which he is entirely consumed, and removed out of the way, that he may not become a nuisance to passengers by his poisonous stench.

When the carcases of fishes are driven upon the shore, the voracious kinds such as the thorn-back, the hound fish, the conger eel, &c. gather about and eat them. But because the flux, and reflux soon change the state of the sea, they themselves are often detained in pits, and become a prey to the wild beasts, that frequent the shores. Thus the earth is not only kept clean

from the putrefaction of carcases, but at the same time by the oeconomy of nature the necessities of life are provided for many animals. In the like manner many insects at once promote their own good, and that of other animals. Thus knats lay their eggs in stagnant, putrid and stinking waters, and the grubs that arise from these eggs clear away all the putrefaction; and this will easily appear, if any one will make the experiment by filling two vessels with putrid water, leaving the grubs in one, and taking them all out of the other. For then he will soon find the water, that is full of grubs, pure and without any stench, while the water that has no grubs will continue stinking.

N.B. Lice increase in a wonderfull manner in the heads of children, that are scabby, nor are they without their use, for they consume the redundant humours.

The beetle kind in summer extract all moist and glutinous matter out of the dung of cattle, so that it becomes like dust, and is spread by the wind over the ground. Were it not for this, the vegetables that lye under the dung, would be so far from thriving, that all that spot would be rendered barren.

As the excrements of dogs is of so filthy and septic a nature, that no insect will touch them, and therefore they cannot be dispersed by that means,

means, care is taken that these animals should exonerate upon stones, trunks of trees, or some high place, that vegetables may not be hurt by them.

Cats bury their dung. Nothing is so mean, nothing so little, in which the wonderfull order, and wise disposition of nature does not shine forth.

Lastly, all these treasures of nature so artfully contrived, so wonderfully propagated, so providentially supported throughout her three kingdoms, seem intended by the Creator for the sake of man. Every thing may be made subservient to his use, if not immediately, yet mediately, not so to that of other animals. By the help of reason man tames the fiercest animals, pursues and catches the swiftest, nay he is able to reach even those, which lye hid in the bottom of the sea.

By the help of reason he increases the number of vegetables immensely, and does that by art, which nature, left to herself, could scarcely effect. By ingenuity he obtains from vegetables whatever is convenient or necessary for food, drink, cloathing, medicine, navigation, and a thousand other purposes.

He has found the means of going down into the abyfs of the earth, and almost searching its very bowels. With what artifice has he learned

to get fragments from the most rocky mountains, to make the hardest stones fluid like water; to separate the usefull metal from the useles dross, and to turn the finest sand to some use! In short when we follow the series of created things, and consider how providentially one is made for the sake of another, the matter comes to this, that all things are made for the sake of man, and for this end more especially, that he by admiring the works of the Creator should extoll his glory, and at once enjoy all those things, of which he stands in need, in order to pass his life conveniently and pleasantly.

§. 20.

This subject concerning the oeconomy of nature, a very small part of which i have lightly touched upon, is of such importance and dignity, that if it were to be properly treated in all its parts, men would find wherewithal to employ almost all the powers of the mind. Nay time itself would fail before even the most acute human sagacity would be able to discover the amazing oeconomy, laws, and exquisite structure of the least insect, since as Pliny observes, nature no where appears more herself, than in her most minute works. Every species of created beings deserves to engross one examiner.

+ If according to a gross calculation we reckon in the world 20000 species of vegetables, 3000

See Ray. Durham - Hist. &c

of worms, 12000 of insects, 200 of amphibious animals, 2600 of fishes, 2000 of birds^m, 200 of quadrupeds; the whole sum of the species of living creatures will amount to 40000. Out of these our countrey has scarcely 3000, for we have discovered only about 1200 native plants, and about 1400 species of animals. We of the human race, who were created to praise and adore our Creator, unless we choose to be mere idle spectators, should and in duty ought to be affected with nothing so much as the pious consideration of this glorious palace. Most certainly if we were to improve and polish our minds by the knowledge of these things; we should besides the great use which would accrue to our œconomy, discover the more excellent œconomy of nature, and more strongly admire it when discovered.

*Omnium elementorum alterni recurfi sunt,
Quicquid alteri perit in alterum transit.*

THE foregoing piece, though on a subject often treated by learned and ingenious men, seems to me to contain many things new and curious, and to give a more comprehensive and distinct

^m How the author came to reckon 2000 species of birds in the world I cannot guess, for in the Syft. Nat. Linn. edit. 6. there are only about 150 mentioned, and in the last edition of that book not above 550.

view, as it were in a map, of the several parts of nature, their connections and dependencies, than is any where else to be found. But exclusive of this or any other comparative merit, it certainly conveys an usefull lesson, and such an one as the best of us often want to have inculcated.

From a partial consideration of things, we are very apt to criticise what we ought to admire, to look upon as useless what perhaps we should own to be of infinite advantage to us, did we see a little farther; to be peevish where we ought to give thanks, and at the same time to ridicule those, who employ their time and thoughts in examining what we were, i. e. some of us most assuredly were, created and appointed to study. In short we are too apt to treat the Almighty worse than a rational man would treat a good mechanic, whose works he would either thoroughly examine, or be ashamed to find any fault with them. This is the effect of a partial consideration of nature; but he who has candor of mind and leisure to look farther, will be inclined to cry out :

How wond'rous is this scene ! where all is form'd
With number, weight, and measure ! all design'd
For some great end ! where not alone the plant
Of stately growth ; the herb of glorious hue,
Or food-full substance ; not the laboring steed,

The

The herd, and flock that feed us ; not the mine
 That yields us stores for elegance, and use ;
 The sea that loads our table, and conveys
 The wanderer man from clime to clime, with all
 Those rolling spheres, that from on high shed
 down

Their kindly influence ; not these alone,
 Which strike ev'n eyes incurious, but each moss,
 Each shell, each crawling insect holds a rank
 Important in the plan of Him, who fram'd
 This scale of beings ; holds a rank, which lost
 Wou'd break the chain, and leave behind a gap
 Which nature's self would rue. Almighty Being,
 Cause and support of all things, can i view
 These objects of my wonder, can i feel
 These fine sensations, and not think of thee ?
 Thou who dost thro' th' eternal round of time,
 Dost thro' th' immensity of space exist
 Alone, shalt thou alone excluded be
 From this thy universe ? Shall feeble man
 Think it beneath his proud philosophy
 To call for thy assistance, and pretend
 To frame a world, who cannot frame a clod ?—
 Not to know thee, is not to know ourselves—
 Is to know nothing—nothing worth the care
 Of man's exalted spirit—all becomes
 Without thy ray divine, one dreary gloom,
 WHERE lurk the monsters of phantastic brains,
 Order

Order bereft of thought, uncaus'd effects,
Fate freely acting, and unerring Chance.

WHERE meanless matter to a chaos sinks
Or something lower still, for without thee
It crumbles into atoms void of force,
Void of resistance—it eludes our thought.

WHERE laws eternal to the varying code
Of self-love dwindle. Interest, passion, whim
Take place of right, and wrong, the golden chain
Of beings melts away, and the mind's eye
Sees nothing but the present. All beyond
Is visionary guess—is dream—is death.





ON THE
FOLIATION of TREES;

O R

The time when they put out their
leaves.

By *HARAL BARCK.*

Upsal, 1753. May 3.

§ I.

BOtanists in every age have not only taken great pains to discover and give names to plants, but have also described them with all possible accuracy. But this part of knowledge has been, till this present age, confined to narrower bounds than it deserved, for an opinion has prevailed amongst almost all the men of learning, that it is of no use out of the regions of medicine.

medicine. From whence it has happened, that we find very few that have cultivated botany, but physicians, nor have even these carried their inquiries farther than to obtain a moderate knowledge of officinal plants. But in our times some, who are worthy of the highest regard from all true lovers of this study, have endeavoured to find out, and investigate the virtues of plants with greater care, and industry. For these men besides medical uses have discovered great, and remarkable advantages accruing from such researches.

However i do not intend to give a catalogue of them here, but shall content myself with just touching upon some few things, that have been done in this way, in our own university. In the *Philosophia Botanica* our illustrious president has shewn, that every soil has its own peculiar plants, which we should seek for in vain any where else; and that certain plants keep, as it were, their watches, i. e. expand their flowers and close them again at stated times". The dissertation on the espouls of plants has imparted to the learned world the use of various phenomena, which occur in the foecundation of plants. The *Flora oeconomica* has faithfully set forth the use of plants in private life. The dissertation on

Vid. *Philos. Botan.* p. 263. 273. Barck.

the

the buds of plants has opened to us the cause, why various trees cannot bear the snows, and frosts of our part of the world. From the essay on the esculent plants of our countrey we find, that there are many plants growing with us, which are proper for food, hitherto overlooked. In the Swedish Pan it is shewn, that certain plants only are destined for sustenance to certain animals. From the *Hospita Insectorum Flora* we are informed that certain vegetables are eat by certain species of insects.

It is now the fourth year since our illustrious president exhorted his countreymen to observe with all care and diligence, at what time every tree expands its buds, and unfolds its leaves; imagining, and not without good reason, that our countrey would some time or other, from observations of this kind made in different places, reap some new, and perhaps unexpected advantage. Upon this admonition, i at that time living in Smoland with that noble person G. A. Witting major, and knight of the military order, was incited to observe for the space of three years, beginning from the year 1750, the days when different trees began to put out their leaves, when the countreymen sowed their fields, and how much time there passed between seed time, and harvest. This i did with intent, if possible, to find out fixed laws by which to regulate the

proper feed time in every province. But the few observations, which i was able to make, were not sufficient for this purpose; that the work therefore which i meditated might not rest upon too slight a foundation, our president communicated all the papers sent to him from different places for my examination. Such then is the design of this essay, and i submit it to the candid reader, hoping that he will look upon it with an indulgent eye.

§. 2.

Our lands, which lye under a cold sky, are bound up with frost all the winter. Hence the roots of our plants oppressed, as it were, with a drowsy sleep, are benumbed, and many herbs, that remain above ground, dye°. But when the sun by its mild rays at the beginning of spring refreshes the earth, the snows melt, the ice gives way, the frost is dissolved, and a joyfull face of things returns. Immediately we see the vernal flowers begin to celebrate their nup-

° We have had five winters remarkably severe in Sweden, viz. 1665, ¹⁶⁸²~~1684~~, ¹⁷⁰⁸~~1709~~, ¹⁷¹⁸~~1719~~, and 1751. The cold of which last Feb. 1. N. S. was extremely intense, and such as has scarcely been known in this age, for the botanic thermometer sunk to 32 degrees, Barck. In that thermometer the freezing point is 0, and that of boiling water 100. So that taking it for granted that the author must mean 32 below 0, this point would answer to 57 below 32 or the freezing point of Farenheit, which is a degree of cold never known in this country.

See p. 221.

tials,

hals; and the trees, one after another, open their buds, and cloath themselves with leaves. It is a matter of wonder why the wood plants, as the spurge laurel, the wood anemone, the noble liverwort, the vernal vetch, the broom rape, the pasque flower, the colts-foot, the sage of Jerusalem, pilewort, violets, &c. and the garden plants, as the affara bacca, snow drops, bulbous violet, vernal crocus, &c. should flower in the very beginning of spring; when we cannot by any pains, or care bring them to flower in the autumn, or after the summer solstice. For it is remarkable that these plants; which are so very patient of the cold in the spring, are yet in the autumn so tender, and weak, that they dye like the Indian plants upon the first hoar frost, e. g. the blue mountain

The iron nights, as they are called in the Swedish language, i. e. sharp nights, happen generally at Upsal between the 19th and 31st of August. e. g. 1746 they began the 19th, 1748 the 17th, 1749 the 1st of Sept. 1750 the 20th of August, 1751 the 27th, 1752 the 20th. They seldom last above three or four nights. After these barley does not grow, and about the time they come on, the gardeners do not venture to trust their green-house and other tender plants any longer to the open air. At that time the leaves of the fig, the mulberry, the walnut, the vine, the toxicodendrum and even of the beech are shrivelled up. The Indian plants, such as the kidney bean, the African marygold, the cucumber, the amaranth, the convolvulus, the tobacco, the thorn apple, &c. dye. Nay sometimes even our native plants, as the noli me tangere, the lesser burdock,

thistle, touch-me-not, &c. On the contrary we see the succories and thistles never flower before the same solstice, whence the husbandman judges from their flowers, as from a calendar that cannot deceive, that the solstice is past. From hence it is evident, that there is something else besides moisture and heat, which promotes the fertility of plants.

§. 3.

In the same manner trees observe fixed laws; and a certain order in their leafing, so that he, who is but moderately versed in this affair, may immediately know, when he sees one species of trees in leaf, what species will be next in leaf. Nor do we hardly ever find this order of Flora transgressed. He who should imagine he had found the true cause of this phenomenon in the different depths of the roots of different trees would be mistaken; for then shrubs would always be in leaf before trees of one, and the same kind; which yet rarely happens. This phenomenon therefore arises without doubt from some other cause, hitherto undiscovered, and perhaps explicable only by the different texture of the tree.

dock, the bryony, the vipers buglos, the pimpernel, the blue mountain sow-thistle, the goosewort, &c. wither. But before this happens, the meadow saffron puts forth its flowers, and that sometimes later, sometimes sooner, according to these iron nights come sooner or later. Barck.

The

The order of the leafing of trees with us is as follows

- | | |
|---------------------|------------------------|
| 1 Red elder | 17 Water elder |
| 2 Honey suckles | 18 Birch |
| 3 Gooseberry | 19 Hazel |
| 4 Red currant | 20 Elm |
| 5 Spiraea frutex | 21 Dog rose |
| 6 Bird cherry | 22 Pear tree |
| 7 Spindle tree | 23 Plum tree |
| 8 Shrubs cinquefoil | 24 Buckthorn |
| 9 Common elder | 25 Berry-bearing alder |
| 10 Privet | 26 Lime tree |
| 11 Quicken tree | 27 Beech |
| 12 The osier | 28 Aria Theophrasti |
| 13 Alder | 29 Asp |
| 14 Sea buckthorn | 30 Maple |
| 15 Apple tree | 31 The oak |
| 16 Cherry tree | 32 The ash |

With

As I do not know that any thing of this kind has ever been published in England; I will subjoyn the order of the leafing of some trees and shrubs, as observed by me in Norfolk, Ann. 1755.

1 Honey suckle	Jan. 15	11 Apricot	Apr. 6
2 Gooseberry	March 11	12 Peach	6
3 Currant	11	13 Filbert	7
4 Elder	11	14 Sallow	7
5 Birch	April 1	15 Alder	7
6 Weeping willow	1	16 Sycomore	9
7 Raspberry	3	17 Elm	10
8 Bramble	3	18 Quince	10
9 Briar	4	19 Marsh elder	11
10 Plumb	6	20 Wych elm	12
	12	21 Quicken	

With the first soft breeze, says Pliny, the cornelian cherry puts forth its buds, next the bay a little before the æquinox. The lime, the maple, the poplar, the elm, the fallow, the alder, the filbert and hazel are among the first that put out leaves; the plane tree also is very early. Nat. Hist. lib. 16. 25.

The foliage or leafing of the first four named trees, 1, 2, 3, 4, varies very much as to the time, and the day on which they break bud; for as the winter goes off sooner or later, so they are in leaf sooner or later. But this does not hold of the rest, e. g. in the year 1750, in which there was scarcely any winter weather, but the whole was almost a perpetual spring, I observed towards the latter end of March, that the currant and gooseberry were in blow about Gripenberg; whereas the last year they did not blow till the middle of April. The oak, and the ash seldom shew their leaves before the night frosts are over*. For which reason gardeners

21 Quicken tree	Apr. 13	29 Maple	Apr. 19
22 Hornbeam	13	30 Walnut	12
23 Apple tree	14	31 Plane	21
24 Abele	16	32 Black poplar	21
25 Chestnut	16	33 Beech	21
26 Willow	17	34 Acacia robinia	21
27 Oak	18	35 Ash	22
28 Lime	18	36 Carolina poplar	22

* This agrees with lord Bacon's observation, Nat. Hist. p. 146. that a long winter makes the earlier and later flowers come

do not venture to trust their house plants to the open air, till the leaves of the last trees give signs of a mild winter.

§. 4.

The prudent husbandman will above all things watch with the greatest care the proper time for sowing; because this with the Divine assistance produces plenty of provisions, and lays the foundation of the public welfare of the kingdom, and of the private happiness of the people. The ignorant farmer being more tenacious of the ways, and customs of his ancestors, fixes his sowing season generally to a month, and even to a day; whether or no the earth be prepared to receive the seed he little cares. From whence it frequently happens, that the fields do not return what might be expected, and that what the sower sowed with sweat, the reaper reaps with sorrow. Wise oeconomists therefore in all ages have endeavoured to their utmost to fix a certain time for sowing; but hitherto their labor has proved fruitless. There have been some, who have tried to discover the qualities of the land necessary for this purpose, by taste and smell; nor have

come together. This I observed was the case in the year 1755, which was a remarkable long winter. The author says in a note, that it has been observed for above ten years past, that the oak has been always in leaf before the end of May, in Upland,

there been wanting others, who were persuaded, that the smell of the earth, and the *fila diva virginis*, were infallible signs of seed-time. All which, although perhaps they are not wholly without foundation, are yet insufficient for obtaining the end we aim at. For the experience of many years has taught us, that the seeds of one and the same species sown in the same ground at different times do not produce equal crops. We have seen even a great difference between what was sown in the morning, and the afternoon. Thus also while one plant is vigorous and flourishes, another of the same nature, and raised in the same soil withers, and dyes. The farmer often throws the cause of scarcity upon Providence, that means to punish an ungratefull people, by ordering the fields to mourn in weeds, and the corn to mock the threshers toil with empty husks; but it may be with truth asserted, that this surmise is often without foundation. He ought rather to complain of his own imprudence and accuse himself that his granary is not better stored.

We look up to the stars; and without reason suppose that the changes on earth will answer to

the
This looking up to the stars for this purpose, was transmitted down to us by the Greeks and Romans from Egypt, where the seasons being much more regular than in these northern

to the heavenly bodies ; entirely neglecting the things that grow round about us. We see trees open their buds, and expand their leaves ; from hence we conclude that spring approaches, and experience supports us in this conclusion ; but no body hitherto has been able to shew what kind of tree Providence intended should be our calendar, so that we might know on what day the countreyman ought to sow his grain.

The sun acts on the earth by loosening, warming, and preparing it, as the culinary fire does on our meat, for which a certain degree of heat is requisite. For the sun by its heat drives the juices taken in by the roots thro' the vessels of the tree, which do not return by circulation, but

northern parts, might be as sure a guide in that countrey, as any they could follow. But a calendar perhaps may not be so good a guide to us as the vegetation of certain plants ; supposing we could once fix on the proper one for sowing each kind of seed. I have been told by a common husbandman in Norfolk, that when the oak catkins begin to shed their seed, it is a proper time to sow barley ; and why might not some other tree serve to direct the farmer as to other seeds ? The prudent gardener never ventures to put his house plants out, till the mulberry leaf is of a certain growth.

It is wonderfull to observe the conformity between vegetation and the arrival of certain birds of passage. I will give one instance as marked down in a diary kept by me in Norfolk in the year 1755. April the 16th young figs appear, the 17th of the same month the cuckow sings. Now the word *κικλὼ* signifies a cuckow, and likewise the young fig, and the reason given for it is that in Greece they appeared together. I will just add that the same year I first found the cuckow flower in blow the 19th of April.

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become more copious by the daily addition of fresh heat. It. Scan. 24.

§. 5.

Nature always takes the easiest, and shortest way in all her works. He therefore who would imitate her must do the same. No one, i think, can deny but that the same force, which brings forth the leaves of trees, will also make the grain vegetate; and no one can justly assert that a premature sowing will always, and every where accelerate a ripe harvest. Perhaps therefore we cannot promise ourselves a happy success by any means so likely, as by taking our rule for sowing from the leafing of trees. We must for this end observe, in what order every tree according to its species, heat of the atmosphere, and quality of the soil, puts forth its leaves. Afterwards comparing together the observations of many years, it will not be difficult from the leafing of trees to define the time, if not certainly, yet probably, when not only barley, but vernal rye, oats, and other annual plants ought to be sown.

§. 6.

To attain this end there were many, who by the exhortation of our president noted, not only the time of the foliation of trees, but the day also, on which barley was sown, and cut; and were

were so kind as to communicate to me their observations. I acknowledge myself much obliged to each of these worthy gentlemen for the benevolence shewn me on this occasion, and more particularly to D. Torén, who for the space of three years made his observations on a tree of the same species with care and diligence; as also to D. Eric Ekelund, who did the same with the like industry for two years. Some perhaps had not always time, or opportunity to make their experiments with the same attention; for those, who are detained in cities, often want a sufficient number of trees to observe these things as they ought, and those, who live in the country, are often drawn by domestic affairs from things of this nature. But if observations were made according to the following rules. 1st, That they should be continued for three years, and those specified, as well as the places in every observation. 2d. That they should be made on the same individuals. And 3d. on trees which grow on the same soil, and in the same exposition, as the field that is to be sown. Were these circumstances, I say, attended to, perhaps we might be able to form more certain rules for the use of the farmer; but since these rules have been sometimes neglected, our business will not succeed so well; for who does not know that the north wind, shade, and a moist soil hinder the leafing
of

of trees as much as a dry situation on the slope of a hill inclining to the south promotes it? Besides many errors have crept into these observations, e. g. some trees between whose leafing there ought not to intervene above two or three days, are often disjoyned from one another by the interval of a fortnight; not to mention the order of leafing § 3, which trees scarcely, or rather never transgress, being tyed down to it by nature herself, but which often does not appear in these journals¹.

§. 7.

If we consider the year 1750, we may remember, that the winter was milder than ordinary, and the spring very early. Whence some in Upland sowed their lands about the end of February; which they scarcely ever do in other years before April. I am not ignorant, that the lands in some of the northern provinces, especially those which abound in clay, require early sowing, that the ground may be broken with less trouble, and that the first shoots of the barley may make their way through it before it grows stiff. But the people of Scania, and

¹ In the original there follows a section which i have not translated. The intent of it is to explain a table giving an account of the different days of the foliation of some trees and shrubs in Sweden, Norway, &c. which i have omitted, as thinking it would afford little, or no entertainment to the reader.

others,

others, that dwell near the sea, sow late whether the spring be early or not; and that sometimes to their great loss, for no other reason but that they received this custom from their ancestors. The most northern inhabitants of Sweden find it necessary to sow, as soon as the frost breaks up; that the short summer may perfectly ripen the grain before the winter approaches. For as eggs require a fixed time for the exclusion of the young, so the barley does in different provinces, to ripen the seed. To prove this I will produce some examples.

	Sowing.	Harvest.	Days.
Pithoa. 1740	June 4	Sept. 1	89
1741	May 29	Aug. 31	94
1742	27	29	94
1743	27	26	91
1744	31	26	87
1745	24	27	95
1746	26	25	91
1747	28	23	87
1748	June 4	22	79
1749	May 21	22	93
1750	19	14	87
1751	21	11	92

Medium 85

(124)

	Sowing.	Harvest.	Days.
Upsal.	1747 April 28	Aug. 17	111
	1748 29	20	113
	1749 May 6	27	113
	1750 April 16	30	155
	1751 28	24	118
	1752 30	31	92

Medium 105

Nafinge	1750 April 20	Aug. 12	113
toward	May 4	7	95
Norway	19	12	85
	21	14	85
	26	15	81
	June 13	25	73

Medium 93

Korn an	1731 May 28	Aug. 31	95
ifland of	1732 June 18	Sept. 14	88
Bahus.	1734 May 9	Aug. 18	101
	1735 25	15	82
	1736 29	27	90
	1738 June 3	Sept. 5	94
	1739 May 8	3	118

Medium 100

From these observations, which i have produced, and many others, i can conclude nothing at present, unless that the sowing of barley

It nearly coincides with the foliation of the birch, at least in Upland, and other places adjacent; and if this sign is not to be depended upon every where, yet it would be easy for us, on a due examination, to find out some other tree, more suited to this purpose; and which some provinces might use as a calendar, while the greatest part might consult the birch. It is a popular error, that less time passes between the sowing, and ripening of wheat in our northern provinces, than here at Upsal, and that this happens because the summer days are longer in the north, and there is scarcely any night to retard its growth. But this error is made evident by the grain ripening in as short a time in Scania, as in Lapland. For barley in the champaign part of Scania is sown about May the 29th, and reaped sooner than in Upland. But why barley ripens later in Upland and Westmania, than in the other provinces of Sweden, is to me absolutely a secret.

§. 8.

If a number of future observations shall confirm the doctrine, which I have been delivering, I do not doubt but that we may reap many advantages from it. For then we should not want a sure guide for the husbandman to regulate himself by in sowing his grain, and for the gardener

seer to sow his kitchen, and other seeds. What great benefit therefore would arise to the public, if one in every province would yearly make observations in this way, and at last communicate them in the same manner, as astronomers do their meteorological ones to the royal society, or academy of sciences?

It will besides be necessary to remark what sowing, made on different days in the spring, produces the best crop; that comparing these with the foliation of different trees, it might appear which is the most proper time for this purpose. In like manner it will not be amiss to note at what time certain plants, especially the most remarkable in every province, blow; that it might appear whether the year made a flower or a quicker progress. For we see, although observations of this kind have yet not come into use, that the mower can give a guess at the time proper for cutting grass, either from the flowers of the parnassia; the devils bit, the marsh gentian, or the bastard asphodel bursting forth, or from the flowers of the purple meadow trefoil withering, or from the ripening of the seeds of the yellow rattle, or in higher places from the yellow hue of the leaves of the leopards bane. Would botanists like astronomers note the time of foliation, and flowering of trees and herbs, and the days on which the seed is sown, flowers and

and ripens; and continue these observations for many years, there can be no doubt, but that we might find some rule, from which we might conclude at what time grains, and culinary plants, according to the nature of each soil, ought to be sown; nor should we be at a loss to guess at the approach of winter; nor be ignorant whether we ought to make our autumn-sowing later or earlier. Lastly, the gardener would have a most sure prophet to consult; whereas now he guides himself by nothing but very fallacious conjectures.

§. 9.

This is all which i think fit to produce upon this copious subject; and i hope the candid reader will not be surpris'd, that i am so short upon it, as it has hitherto not been handled; and is far from being hitherto perfectly understood. It is much above my power to go to the bottom of this affair, but by touching upon it in a summary way i mean to excite men of greater ability, who may treat it in the manner it deserves.



OF THE
USE of CURIOSITY.

BY

CHRISTOPHER GEDNER.

Upsal, 1752. October 21.

Amæn. Academ. vol. 3.

§. 1.

AS the three kingdoms of nature were created for the use of man, since to him alone is granted the prerogative of converting their inhabitants to his own advantage, so that part of knowledge which is conversant about the creatures throughout the terraqueous globe is the first, and chief by which men are enabled to provide themselves with what is necessary, both for the present, and future ; and the more so because, besides these three kingdoms, and the elements

ments there is nothing in nature which can be of use to him. All those things by which man is supported and grows, with which he is cloathed, and in which he prides himself, by which he is preserved, and becomes insolent; all the pomp, the splendor, the richness, the luxury of dress, as well as the necessary covering from hence have their origin. Without these things man must be as naked, as he was created, and came into the world. However obvious this truth may be, there is a common question proposed by the vulgar to men, who are busied in examining the productions of nature, and that with some sort of sneer; To what end are all these inquiries? By which they mean to insinuate, that these virtuosi are at the bottom, but madmen, who spend their time in a kind of knowledge, which promises no advantage; and in this way of thinking they are the more convinced of being right, as they find natural history no part of public institutions, not received into academies amongst the philosophical sciences, and as holding no rank either in church, or state. For this reason they look on it as a mere curiosity, which only serves as an amusement for the idle, and indolent. This objection has been made to myself, and almost all others who give themselves up to the study of nature, and by its frequent repetition

tion has at last quite worn out my patience. For which reason i think it will not be amiss to consider the question, and prepare such an answer to those, who for the future shall not be ashamed to urge over and over the same objections, as may convince them, if they will take the pains to read the few following pages, and consider them thoroughly. All i desire of the reader is a candid hearing.

The kind of men, who most frequently ask this question; To what end all these inquiries? are of a heavy, dull, and phlegmatic disposition, of weak judgment, and low education. Amongst ourselves, in great cities, in large towns, and at academies, the searching into nature ceases now to be uncommon. Nor is this question ever heard among men of solid learning. It is chiefly, and frequently put in the more remote provinces by the inferior order of people; who think of nothing but indulging their low appetites, and look on every thing as useless, which does not serve that purpose.

When electrical experiments first began to make a noise in the world, Samuel Klingenshierna was sent for by his majesty Frederic the first to shew him some of the electrical phenomena. When all was over, a man of great rank, who happened to be one of the spectators on this occasion,

cation, said with a sneer, " Mr. Klingenstierna " of what use is all this? " Klingenstierna replied with some acuteness, " Sir, this very objection was made to me by J. C. " (this J. C. was a very rich dry salter). Upon which the king said smiling, to the nobleman, i think he has given it you. Such men as these resemble more the brute creation, than rational creatures. They do not consider, that the all-wise Creator made every thing for man's use. They forget that every thing, which was created at the beginning, was declared to be good. To these men whatever is curious is disgustfull, and inquiries into nature are deemed mere folly.

Ternaström (Christ.) when he went with the Ostend fleet to the East Indies, was treated with contempt by some of the company for his curiosity. They thought nothing of consequence, but what belonged to the winds, and waves.

Bartseius (John) when he arrived at Surinam, where he went in order to make observations in natural history, was despised for looking after plants, and insects. The inhabitants there thought nothing worth minding, but what belonged to sugar and coffee plantations. Vid. his letters to Linnæus. Professor Kalm dared not at the hazard of his life let the savages of Canada, amongst whom he resided, know that he de-

scribed any plant or other natural object, but was forced to carry on all his researches in private. When our president was gathering, and describing the rein-deer-fly on the Lapland mountains, the inhabitants wondered, and laughed at him for troubling his head about catching insects. Vid. Act. Stockhol. vol. 1. p. 121. And we find that he, and his companions were stared at as a spectacle in his journey through Oeland. It. Oeland. p. 85. 109.

Dr. Hasselquist was forced to have a guard whenever he went out of Cairo in order to describe any natural object; and even then he was not quite safe from the vulgar on account of his curiosity. These examples may suffice without producing any more.

§. 3.

We were created for the glory of the Creator, which cannot be brought about unless we know him, either by revelation, or the works of the creation. As to the latter i suspect, that many come into the world, and remain here even to old age, who never saw the creation, but from afar; just like the brute beasts, which cannot fail of seeing the verdure, and various colors, that cloath the earth, but go not one step farther. This seems to me as if any one, who should be carried into a botanic garden to see the
immense

immense variety of plants brought together from all parts with incredible trouble, care and expence, should only observe that the leaves were green, and the flowers of various colors, just as they are every where else. Could such an one be truly, and justly said to have seen the garden? Or if any one should go into a museum, filled with natural objects of the rarest kind preserved in spirit of wine, and should only attend to the clearness of the liquor, and, though he saw a body hanging in it, should not inquire what body it was, would not he, who took the trouble of shewing these sights to so incurious a person, think his time thrown away? Would such a spectator deserve to be let into such a place?

I cannot help on this occasion calling to mind the manner, in which our president used sometimes to excite attention in his audience by an apt similitude, when he was demonstrating insects to his pupils. The similitude or rather fable was as follows. Once upon a time the seven wise men of Greece were met together at Athens, and it was proposed that every one of them should mention what he thought the greatest wonder in the creation. One of them, of higher conceptions than the rest, proposed the opinion of some of the astronomers about the fixed stars, which they believed to be so many suns, that had each their planets rolling about them,

and were stored with plants and animals like this earth. Fired with this thought they agreed to supplicate Jupiter, that he would at least permit them to take a journey to the moon, and stay there three days in order to see the wonders of that place, and give an account of them at their return. Jupiter consented, and ordered them to assemble on a high mountain, where there should be a cloud ready to convey them to the place they desired to see. They picked out some chosen companions, who might assist them in describing, and painting the objects they should meet with. At length they arrived at the moon, and found a palace there well fitted up for their reception. The next day, being very much fatigued with their journey, they kept quiet at home till noon; and being still faint they refreshed themselves with a most delicious entertainment, which they relished so well, that it overcame their curiosity. This day they only saw through the windows that delightfull spot, adorned with the most beautifull flowers, to which the beams of the sun gave an uncommon lustre, and heard the singing of most melodious birds till evening came on. The next day they rose very early in order to begin their observations; but some very beautifull young ladies of the countrey, coming to make them a visit, advised them first to recruit their strength

before

before they exposed themselves to the laborious task they were about to undertake.

The delicate meats, the rich wines, the beauty of these damsels prevailed over the resolution of these strangers. A fine concert of music is introduced, the young ones begin to dance, and all is turned to jollity; so that this whole day was spent in gallantry, till some of the neighbouring inhabitants, growing envious at their mirth, rushed in with drawn swords. The elder part of the company tried to appease the younger, promising the very next day they would bring the rioters to justice. This they performed; and the third day the cause was heard, and what with accusations, pleadings, exceptions, and the judgment itself the whole day was taken up, on which the term set by Jupiter expired. On their return to Greece all the country flocked in upon them to hear the wonders of the moon described, but all they could tell was; for that was all they knew; that the ground was covered with green, intermixed with flowers, and that the birds sung amongst the branches of the trees; but what kinds of flowers they saw, or what kinds of birds they heard, they were totally ignorant. Upon which they were treated every where with contempt. If we apply this fable to men of the present age we shall perceive a very just similitude. By these three days the

fable denotes the three ages of man. First youth, in which we are too feeble in every respect to look into the works of the Creator. All that season is given up to idleness, luxury and pastime. 2dly. manhood, in which men are employed in settling, marrying, educating children, providing fortunes for them, and raising a family. 3dly. old age, in which, after having made their fortunes, they are overwhelmed with lawsuits, and proceedings relating to their estates. Thus it frequently happens that men never consider to what end they were destined, and why they were brought into the world.

§. 4.

As to bodies, the vulgar are ready enough to admire them in the larger kinds of animals, plants, minerals and metals. But when they perceive any one examining into the minute parts of nature, such as insects and shells, grasses and mosses, earthy particles, and petrifications, they look upon it as idle curiosity. And when they see us searching after such natural productions of foreign countries, as are not found with us, their wonder increases, and they think then they attack us with double advantage. Since we not only spend our time in examining present objects, that are wholly useless, but even such distant ones, as we have scarcely any means of coming at. They have no notion that these
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can be of any manner of use but to those amongst whom they are found. To the end therefore that we may gain a clearer conception of the harmony, and use of these things, it will be necessary to run thro' some of the most obvious particulars, relative to this subject, that every one from hence may beter comprehend the advantage of natural history in general.

§. 5.

The antients were of opinion, that the bodies about us concerned us no farther than as they were good for food or phyfic. Hence their inquiries all tended to find out what were fit to eat, and what would cure some distemper, and whatever plant or animal could not be referred to one of these classes was neglected^r. It is true

^r I must take the liberty to contradict the ingenious author on this occasion. For any one who has ever looked into Aristotle's history of animals, and Theophrastus's of plants, must at once be convinced of the contrary. This justice i thought due to those two first sketches of natural history, in which the sagacious, and extensive genius of the master, and the disciple fully shine forth. It is true this spirit was not long kept up, nor is it to be wondered at, that extravagant speculations, and systems concerning things out of mens reach, which are pursued in the closet with ease, and when ingenious are apt to strike the imaginations of mankind, should take place of the sober, and painful researches into nature, little minded by the generality of people, and therefore lying out of the paths of reputation. Thus what was it so well begun by Aristotle and Theophrastus dropped at once for want of encouragement, and never raised its head again, till after the

true that the immediate use of many bodies is hitherto unknown to us, yet we have great reason to believe, that all the bodies in the universe, some way or other, contribute to our advantage. Hay, which men take such pains to collect in the summer, is of no use to man immediately, but it is a commodity of the utmost consequence to him mediately, as being the food of cattle of all sorts, without which we could not well subsist. Those minute insects called tree lice, that live upon the branches of trees, and plants, are looked upon as of no use to us. These are devoured by flies, cochineals, golden eyes, &c. in their first state; which also seem to be of no use to us, but then many of the small birds feed upon them, and these not only delight us with their fine songs but afford us most delicate food. The nettle is a plant which is scarcely eat by any domestic animal (Iter. Scand. p. 15.) but the Author of nature has allotted to it more feeders than to almost any other plant, v. gr. butterflies, moths, wevils, chermes, &c. which devour it almost entirely, and these insects are a prey to many birds, which could

the restoration of learning; when Gesner, Bauhin, Cæsalpinus, &c. in imitation of those first masters, began to revive this part of knowledge; and kindled up a spark, which has never been totally extinguished since, and has been raised into a diffusive light by several naturalists of the last age, and particularly by the excellent Linnæus.

could by no means live on the plant immediately. Minute aquatic worms, and those in no small number are eat by the larger, and these are eat by the fishes, and aquatic birds, and these by us; and besides food these birds supply us with most delicate soft down to warm and repose ourselves upon. It would be tedious to enumerate all the mediate advantages, which we obtain from the most contemptible, as they are deemed, both plants and animals.

§. 6.

Many look upon shells, and corals of various kinds, which are collected and ranged in museums by the diligent inquirers into nature, as an idle curiosity; since they neither serve for food or physic; but if these are neglected, how many of the wonderful works of the Creator would be unknown? What man of sense is not struck with wonder, when he beholds the innumerable objects, which the Author of nature has buried, as it were, in the great abyfs. Objects for color, shape, and mechanism so admirable, that they surpass the imagination of man to conceive without seeing them. If we visit a royal palace, and there behold the walls covered with tapestry, pictures, sculpture, and other ornaments, are we not delighted, and even in rapture? We ought therefore to feel the same, when we behold the beauties of this our globe. To describe every shell on this occasion would far exceed

exceed the bounds of my design. At present i will only mention one, viz. the knotted margined *Cypræa*. Rump. t. 39. f. C. Argenvnill. t. 21. f. K. Petiv. Gaz. 97. t. 8. This is a small shell, about the bigness of a hazel nut, and is gathered in the Maldivèè islands by the the women along the sea shore in such quantities, that 30 or 40 ships are loaded with them yearly for Africa, Bengal and Siam; so that in those parts there are large palaces filled with them, where they are preserved as treasures of the greatest value.

These shells serve there as gold, and silver with us, for all kinds of commerce. In other countries other shells are made use of for various purposes; some instead of horns to blow with at their religious ceremonies; some for vessels for washing; some for cups; some for boxes; some for inlaying; all of them far exceeding the best artificial works.

Nor are those innumerable petrifications, so various in species, and structure, to be looked upon as vain curiosities. We find in our mountains, and even in the middle of stones, as it were embaumed, animals, shells, and corals, which are not to be found alive in any part of Europe. These alone, were there no other reason, might put us upon looking back into antiquity, and considering the primitive form of the

the earth, its increase, and metamorphosis. This is a subject, that would require a whole volume to treat it as amply as it deserves.

Wild beasts, and ravenous birds, though they seem to disturb our private oeconomy, are not without their uses; which we should be sensible of, if they were extirpated^a. When the little crow was driven out of Virginia, and that at the expence of several tons of gold, the inhabitants would willingly have brought them back again at double the price, as we find by professor Kalm. The vultures in Cairo are invited yearly, and daily to remain there, as doctor Hasselquist relates in Act. Sac. reg. Scient. Stockhol. 1751. p. 196. et sequ. These creatures of prey cleanse the ground from carcases, and make it wholesome, and pure, and besides they serve to keep up a due proportion between animals, so that one sort may not starve the rest.

The vulgar think, and those who think themselves wiser than the vulgar, make no scruple to say; let him who has nothing to do employ himself in hunting after moles and flies. By

^a Thus in Suffolk, and in some parts of Norfolk, the farmers find it their interest to encourage the breed of rooks, as the only means to free themselves from an insect called scarabæus. Faun. Suec. 345. which in its grub state destroys the roots of the corn, and grass to such a degree, that I myself have seen a piece of pasture land, where you might turn up all the turf with your foot.

which

which they would insinuate, that searching after the minute plants and animals is unbecoming, or at least unnecessary for a rational creature. As for mosses, i grant we have not authority on our side; for till the end of the last century, they were almost wholly neglected; but now within these fifty years their history is very near compleat by the diligence of Dillenius. C. Bauhin knew very few mosses; Dillenius has described near 600. With unwearied pains he went through this very difficult, and extensive branch of natural history. But to what end? it is asked. I will not take upon me to answer this question by shewing the particular use of every moss, that grows; although i am certain the Lord of nature has made nothing in vain. But i will venture to assert, that posterity will, one time or other, find as many advantages arising from mosses, as from other vegetables. I assert this with the greater confidence, because since our acquaintance with mosses, we have many experiments, which shew their usefulness, a few instances of which i shall subjoyn. The bog moss covers deep bogs with its spongy substance, and thus by degrees turns them into fertile meadows; not to mention its repelling virtue in medicine; at present also its turf is used instead of wood in many provinces, and it is a custom established among the workers in metals

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to burn it into cinders in their forges. The Laplanders, who lay their children upon it in the cradle, find that it abates the acrimony of the urine. Act. Stock. 1740. p. 421.

The fontinalis antipyretica, a kind of moss, contrary to the nature of all other mosses, guards the walls of houses in case of fire. It. Scand. p. 20.

The maiden hair furnishes a very convenient bed to the Laplander, and the bear with this prepares his winter habitation. Most of our tumps consist of this kind of moss.

The club-moss is used for making mats.

The cypress-moss furnishes a yellow dye.

The upright fir-moss frees cattle from vermin, and purges strongly. It. Oel. p. 28.

The fountain-moss points out cool springs.

The hypnum proliferum, a kind of moss, covers the ground in shady places, where no other plant will grow.

The hypnum parietinum serves for stopping crevices in walls.

All the kinds of hypna and brya cover the earth with green, and keep it from being quite naked, as in the woods of both the Indies. They preserve the minute seeds of plants during the winter, shelter their roots

Names of mosses.

and

∴ see page 227.

and keep them from freezing; and gardeners gather mosses in the autumn, in order to preserve their plants from the frost; they are gathered by the birds to build their nests; they grow in the most barren soil; by degrees they rot towards the bottom, and thus lay a foundation for fertility.

The *bryum hypnoides* covers the rocks in the coldest mountains.

The *mnium hygrometricum* shews the dryness, and moisture of the atmosphere.

Some kinds of brya cover the mountains, others the marshes, some are usefull in moist meadow ground, some spread over the naked fields, some are found upon stones, and rocks, others on trunks of trees; and all of them bear the most severe winter, when the generality of other plants grow sickly.

§. 7.

As to the lichens or liverworts, they are not of less use; for many of them afford a beautifull dye. e. g. the *roccella* yields a most valuable red color, Aët. Soc. reg. Scien. 1742. p. 21. to which purpose the lichen *tartareus* serves as a *succedaneum*. The lichenes *stygius*, *onophalodes*, &c. afford also a red dye, and the lichenes *croceus*, *vulpinus* a good yellow. There is no doubt, but that many colors in process of time may be obtained from this kind of plants.

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If we consider the vertues of the lichenes or liverworts upon animate bodies taken internally, they are not inconsiderable. The lichen vulpinus is a deadly poison to wolves. It. Scan. p. 40. The lichen pyxidatus, or cup-moss, efficacious in the whooping cough. The lichen jubatus, or rock-hair, in exulcerations of the skin. The lichen omphalodes in stopping hæmorrhages. The lichen aphthosus in thrushes, and against worms. The lichen caninus or ash colored ground liverwort, in the hydrophia and madness. The lichen pulmonarius, or lungwort, is found to be good in consumptions. The œconomical use of lichens is of no small consequence. e. g. the lichen rangiferinus affords the most delicious pasture to the rein-deer. Upon this the whole œconomy of the Laplander turns, and by the help of this many millions of men are supported. This lichen is also given to other cattle by the people of Norland. Act. Soc. reg. 1742. p. 153. Some of the kinds of lichens are the delight of goats. The most barren woods, where no other plants grow, afford us the lichen islandicus, which in time of scarcity serves instead of bread. Act. Soc. reg. 1742. p. 154.

The lichen prunastri, or plumb-liverwort, is ground to powder for the hair.

The lichen pustulatus may be converted into a very black pigment. The very small lichen,

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called

called leprofus, covers barren rocks, and makes them look pleasant; it gives birth to black mould, and consequently affords the first degree of vegetative power. After all this can any one justly say that the knowledge of these plants is useless?

The mushroom kind also make a class of vegetables by no means to be despised. One species is used in amputations, and hæmorrhages, and another is lately come into reputation for stopping the bleeding of arteries; insomuch that the inventor of this use of it was amply rewarded for the discovery.

The truffle and phalli contribute to make our soups more delicate, and are commonly used at the tables of the great. Many mushrooms are eat by the Muscovites and the inhabitants of other countries, but some of them are a most deadly poison; so that it is of the utmost consequence not to commit mistakes in this part of knowledge.

There is a mushroom called *agaricus muscarius*, on account of its driving away flies, and the same plant is the safest remedy hitherto discovered to destroy the bug. Thus the knowledge of these plants is of great use to man.

§. 8.

The grasses also are a kind of plants of great value, as affording food for cattle.

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The great reed grass with chaffy heads serves for thatching houses.

The common fox-tail grass is an excellent grass, which may be sown to advantage in low meadows. It. Oel. p. 156.

The bent-grass causes the meadows in the regio cuprimontana to be so extremely fertile. Act. Soc. R. S. 1742. p. 30.

The great water reed grass is a large and very usefull grass, which grows by the sides of most ditches and rivers. It. W. Goth. p. 41.

The poa angustifolia is the most common pasture in our parts.

The seed of the festuca fluitans or manna grass, affords a very pleasing and wholesome nourishment to man.

The festuca ovina makes our sheep very fat.

The perennial rye-grass, is the best grass for hay on chalky soils.

The sea dogs-grass and sea mat-weed, keep the sands on barren maritime tracts from being blown away.

The most minute seeds of grass afford nourishment to small birds. The grasses besides give a most agreeable color to the earth, and fill up the intervals between plants of other kinds; so that they serve both for pleasure, and utility. The Creator has assigned certain species of grass to every different species of soil, which the hus-

bandman is obliged to know in order to make the most advantage of his lands. Besides certain grasses are eat by some animals, and left untouched by others; so that without the knowledge of these he cannot avoid falling into error.

§. 9.

He that would exercise the art of husbandry with the greatest advantage, ought to endeavor to get acquainted with all kinds of vegetables, and find out what sort of soil suits each of them best. He ought to know, that some delight in open and exposed situations, others in shady; some in moist ground, others in dry; that some plants thrive most in sandy soils, others in claiy, others in black mould, others in spongy ground, others in watry; some ought to be sown in pools, others on the tops of hills.

Those barren desarts called Alvacu on the mountains of Oeland, It. Oel. p. 206. had long ago been covered with the crocus, from whence the inhabitants might have reaped great benefit, if the nature of that plant had been known to them. Our alps, that are more than a hundred miles long, had not remained to this day a mere waste, if our industrious husbandmen, who not long since began to improve the œconomical arts, had known how to cultivate such plants as might have been usefull in food, or physick; and if they had known what usefull trees, and herbs grow

grow on the forreign alps, viz. the Swifs, the Siberian, the Pyrenean, the Valesian, &c. from whence they ought to have got seed.

The banks of our lakes produce scarcely any thing but rushes, horsetail, water lilly, pond-weeds, reeds, &c. where nevertheless a great number of plants fit for food might be sown, such as zizany of Canada, water caltrops, &c.

Every province has its plant, which choaks the grain, and renders the fields foul, and poor. It. Scand. p. 421. Books of husbandry are full of inventions how to break the earth by instruments, and fit it to receive the seed; but this kind of knowledge is insufficient, as long as the husbandman is unacquainted with the nature of those various herbs, to which agriculture ought to be adapted. From hence the necessity of natural history appears.

§. 10.

It is also necessary for the husbandman to know the duration of every plant he sows in his fields, and meadows, viz. whether it be perennial, biennial, or annual. He who wants to know the use of our plants in œconomy, and how few there are, whose use is hitherto discovered, let him look over the Flora œconomica. Amæn. Academ. vol. 1^a.

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* The piece here referred to is full of new observations on the uses of plants hitherto not attended to. I wish I could

We see how many in a time of dearth suffer for want, fall into diseases, and even perish, for no other reason but because they do not know what plants are eatable, and how great a plenty there is of them in our countrey, of which D. Hiorth in this volume has given an account, which the most illustrious senator Baron Lowenheim has translated into Swedish. Many people wonder, why the curious enquirers into nature will give themselves so much trouble about exotic plants; but they do not sufficiently consider, that many kinds of grain, many roots, legumes, fruits, sallads, and trees in common use with us for nourishment, household utensils, cloathing, and ornament are originally exotics. Here follows a list of some, which have lately been brought into our countrey from the farthermost parts of Sibiria, that contribute to adorn our gardens, and change our œconomy.

Larkspur, monkshood, adonis, vetch, cow parsnep, French honey-suckle, astragalus, othonna, bastard-saffron, greater centory, colombine, dracocephalon, speedwell, claytorica, flax, hyacinth, lilly, lychnis, poppy, cat-mint, yellow-flower'd sage, hooded willow herb, hyssop, wild

could have made such a translation of it, as could have been instructive or entertaining to the public; but a long list of the names of plants, which could have conveyed no ideas to such readers, as this work is intended for, must have been very tedious, and very useless.

navew,

navew, St. John's wort, sow-thistle, saw-wort, &c. From that distant countrey we have the robinia's and a honey-suckle, that make excellent quick-hedges; from thence we have the Sibirian nettle, that serves for making sacks. If we had a more compleat knowledge of plants, that grow in the southern parts of Asia, and America, we should be able to make more ample, and usefull experiments.

To preserve our woods we want to be provided with quick-hedges, for which purpose many kinds of trees are serviceable, such as the gooseberry bush, the black-thorn, the white-thorn, the barberry, the sea buck-thorn, the alder, the fallow, &c. provided each be planted in a proper soil.

§. 11.

We have some of our most efficacious medicines, and best spices from the southern parts of the world; and were it not for the curious in botany they had been neglected; as the *lignum colubrinum* was for a long time. What end would it serve to know, that the *senega* root was good against the bite of serpents, unless botanists had also known the plant? And who would ever have dreamed, that our *polygala* would answer the same intent? What end would it have served, that professor Kalm was witness to the

efficacy of the Virginia avens and the monarda in intermitting fevers, and of the root of the ceanothus, and diervilla in venereal cases; if we had not learned how to raise these plants? Or to what end would it have served to cross the ocean, and attain the American water gladiolus, if we had not found out that it was of the genus of our water gladiolus? The Europeans at vast expence went on buying the moxa from China, the figwort from Brazil and the jachaschapuch from North America, till it was known that they grew in our own country.

§. 12.

There is, as it were, a certain chain of created beings, according to which they seem all to have been formed, and one thing differs so little from some other, that if we fall into the right method we shall scarcely find any limits between them. This no one can so well observe, as he who is acquainted with the greatest number of species. Does not every one perceive, that there is a vast difference between a stone and a monkey? but if all the intermediate beings were set to view in order, it would be difficult to find the limits between them. The polypus and the moss joyn the vegetable, and the animal kingdom together, for the plants called conservæ and the animals called coralline, are not easy to distinguish, and the

corals

corals connect the animal, vegetable and fossil world.

Hence the botanists of this age have been busied about settling natural classes, which is an affair of the greatest importance, and difficultly; but since the vegetables hitherto discovered are not sufficient for that purpose, this part of knowledge is not compleat. It is therefore incumbent on botanists to get acquainted with exotic plants, that they may arrive at the end desired. If all the columniferous plants except the musk-mallow were known, the turnera never could be referred to this order, but that, as soon as it was examined, connected the turnera with the columniferous plants.

Where the natural classes are settled we find the vegetables so near akin to one another, that we can scarcely distinguish them, as in the umbellated, the filiquose, the leguminose, the composite, &c. most of these orders grow in Europe, and therefore could be easily known, and ranged.

He that knows but a few plants gives characters, which are easy to find out, but are insufficient to settle any thing; and therefore tend to confound, rather than to advance knowledge; so that the natural method is the ultimate end of our systematical inquiries. Without this all is a mere chaos, and if the knowledge of vegetables fails, all that use of them is gone, which
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the learned in this way might discover to the great benefit of mankind.

It is true indeed that vegetables act upon the human body by smell, and taste; but these marks are not sufficient unless we know the natural orders of plants.

These being known, and the virtues of some vegetables being discovered, we may go on safely in the practice of physic, otherwise not. It follows from hence, that he who desires to make any considerable improvement in this branch of knowledge, must endeavor to get acquainted with those plants, whose use he does not know; and thus he is obliged not to neglect the most contemptible. e. g. no body was able to form a right judgment of the cascarilla, who did not know its natural order. No physician would have even suspected, that our milkwort would be usefull in the bite of serpents, and inflammatory fevers, unless the principles of botany had led him to it. No one has even thought of trying the mitreola Americana against the bite of serpents, which yet without ever seeing it, we may certainly conclude from the ophioarrhiza Asiatica or true lignum colubrinum^t. Whence botanists knew

^t This root is known in the East-Indies to be a specific against the poison of that most dreadful animal called the hooded serpent. There is a treatise in Aman. acad. v. 4. upon

knew the above-mentioned turnera, but were ignorant to what natural class it ought to be referred, no man could guess its virtues. But now that we know, that it is of the columniferous order, we may without experience be assured that it is of the emollient kind.

Without this knowledge of the natural orders, the materia medica would be still as uncertain, as amongst the antients, which is of the utmost importance to us if life and health be so.

§. 13.

We are ready enough to put a due value on

upon this subject, wherein the author Joh. And. Darelus undertakes, from the description of such authors as had seen it upon the spot, to ascertain the plant from which the genuine root is taken. It appears in this account that it had puzzled the European physicians, and what had been sold in the shops for it is the root of a very different plant and of a poisonous nature.

The true root is called mungos for the following reason. There is a kind of weasel in the East-Indies called mungutia by the natives, mungo by the Portuguese, and muncas by the Dutch. This animal pursues the hooded serpent, as the cat does the mouse with us. As soon as this serpent appears the weasel attacks him, and if she chances to be bit by him, she immediately runs to find a certain vegetable; upon eating which she returns, and renews the fight. The Indians are of opinion, that this plant is the mungos.

That celebrated traveller Kämpfer, who kept one of these weasels tame, that eat with him, lived with him, and was his companion, wherever he went, says he saw one of these battles between her and the serpent, but could not certainly find out what root the weasel looked out for. But whether the weasel first discovered this antidote, or not, yet it is certain, adds Darelus, that there is a root, which is an infallible remedy against the bite of the hooded serpent. And this he undertakes to ascertain.

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the larger animals, but many look on the minute tribes of insects, rather created to torment, than to be useful to mankind. We grant that they are very troublesome to us. But is therefore all care about them to be given up? by no means. On the contrary we ought to contrive means to get rid of them, that they may not destroy both us and our possessions. This cannot be brought about unless we know their nature; when that is known we shall more easily find out remedies against them ^u. The use of insects has been sufficiently explained by the noble Carolus de Geer, lord of the bed-chamber to his majesty, in an oration which he made in the academy of sciences at Stockholm. Another of my fellow-students has undertaken to explain what damages insects of various kinds do us, and another now is actually employed in shewing what kind of insects live upon every plant ^u. This makes it
unne-

^u We have lately had a proof that the knowledge of the nature of insects may sometimes be serviceable to us. The sagacious Dr. Wall of Worcester, upon seeing the case of the Norfolk boy, who was cured of worms by taking down a large quantity of white lead, and oyl, guessed that the cure was performed by the oyl, knowing that oyl is fatal to worms and other insects. Upon this he has since tryed oyl in worm-cases with great appearance of success, an account of which I saw in a letter from him to be communicated to the Royal Society.

^w The two last-mentioned persons hinted at are, I imagine
J. G.

unnecessary for me to enlarge at present upon the almost incredible mischief insects do us. I will only in a very few words mention, that we shall never be able to guard ourselves against them, but by their means. For as we make use of dogs, and other beasts, in hunting down stags, boars, hares and other animals, which do us much damage in our fields and meadows; or as hawks may be bred up to as so assist us in taking herons, larks and other birds, so also we might make use of the fiercer kinds of insects, in order to get the better of the rest of these troublesome animals.

We shall never be able to drive bugs out of our houses, before we introduce other insects that will devour them, v. g. the wild bugs, &c.

We have no easier method of destroying knats and flies which cause us so much disturbance, than by providing ourselves with the libellula, which devours them, as the kite does poultry. We oftentimes find our largest trees entirely stripped of their leaves by the caterpillars of the moth kind, &c. but when we search after them we find they are all eat up by the larger kind of carabi called *sycophantæ*; from whence

J. G. Forkahl, and M. Backner, the first of whom has written a treatise shewing the plants which different insects live upon, the last a treatise on the mischiefs done by insects. Both these are published in *Amæn. acad.* v. 3.

we

we may learn, that there is no remedy more efficacious in our gardens, where leaves, flowers, and fruits are almost every year destroyed by those caterpillars, than gathering and preserving the above-mentioned carabi till they lay their eggs, and then placing them at the roots of trees in rotten wood, till they are hatched. And thus we should effectually guard our trees from these inhospitable guests.

§. 14.

But if we do not think it worth our while for any other reason to turn our attention to the works of nature, yet surely for the glory of the great Creator we ought to do it, since in every plant, in every insect we may observe some singular artifice, which is not to be found in any other bodies; and upon comparing these together, we may be convinced, that this does not happen by chance, but was contrived for some certain end, viz. either the propagation, or preservation of the plant or animal with respect to those other bodies. We find how many plants are fenced against the inclemencies of the elements, and the devastations of animals; and how every animal is furnished with some means, by which it may defend itself against the depredations of the rest; so that no species can ever totally perish, which has been created.

Lastly,

Lastly, from the contemplation of nature we may see, that all created things some way or other serve for our use ; if not immediately, yet by second or third means. Nay we may see, that what we imagine to be most noxious to us is not seldom highly usefull. Without some of these things our œconomy would suffer extremely. Thus were there no thistles, or briars, the earth would be more barren. We ought not to overlook the minutest objects, but examine them with the glass ; for we shall then perceive how much art the Creator has bestowed upon them.

He who beholds one of the *jungermanuia*, a kind of wrack with a microscope, must be forced to confess, that he beholds a most stupendous, and wonderful phænomenon. Many thousands of people are supported by rye-bread, not one of them perhaps ever saw, in how surprising a manner its husks are armed ; which any one, who is desirous, may see by the help of a glass.

The day would sooner fail me than matter, were i to take notice of every thing, which this subject affords. Let this then be looked upon as the end of created beings ; that some may be usefull to man as physic, others as aliment ; some in œconomy immediately, others mediately ; some vegetables prepare the ground, some protect those which are more tender, others cover the earth
with

with a green, and most beautifull tapestry, and that perennial ; some form those groves to which we fly for coolness, others adorn our globe with their most elegant flowers, and regale our nostrils with their most delicious odors. Lastly, all things demonstrate abundantly the omniscience of the wise Creator, who created nothing in vain, but contrived every thing with so much artifice, that human art, however great it may be, cannot imitate the least of his productions. If we neglect therefore to consider these objects, they would be like pearl thrown before swine. I beseech you then, who ask me with a sneer to what end this or that stone, plant or animal serves, i beseech you to awake, and open your eyes while you live in this world. All these things are not the work of man, but of wisdom itself, which created both thee, and me. He has settled an œconomy in this globe, that is truly admirable by means of an infinite number of bodies, and all necessary, which bear some resemblance to one another ; so that they are linked together like a chain. For as in our œconomy neither the plough, nor the hedges, nor the dunghill are fit for food, or physic, yet are absolutely necessary, so in the œconomy of nature there are many things, that are as necessary, but not immediately. Men reckon their œconomy amongst the chief of human inventions, consider then the sublimity of the divine œconomy,

economy: You see therefore that it must at last be granted me according to the opinion of divines and philosophers, that every thing was created for the use of man, and man for the glory of the Creator. Can you then believe, that any thing can be useless that serves not for food, or physic? The Creator has so framed the world, that man should every where behold the miraculous works of his hands, and that the earth should afford an endless variety, seemingly with intent that the novelty of the objects should excite his curiosity, and hinder him from being disgusted by too much uniformity, as it has happened to some wretches, whose station in life placed them above labor, and who wanted curiosity to look into these things. Some objects were made to please the smell, the taste, the sight, the hearing, or other senses, so that nothing can be said to be without its use. That branch of knowledge which serves to discover the characters of natural things and teaches us to call them by their names, seems perhaps by no means necessary. But let it be considered that the first degree of wisdom is to know things when we see them, i. e. to know them by their names; and without this knowledge scarce any progress can be made. To know the letters of the alphabet, to joyn them into syllables, to understand words is not solid erudition; yet it is absolutely necessary for

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him,

him, who would become learned. Thus the characters, and names of things must be thoroughly learned in order to obtain any use from natural history. We find in the journals of travellers, many things mentioned, partly curious, partly usefull concerning animals, plants, and stones; but those observations can be of no use to us, till we are able to refer each to its distinct species; that we may make them a part of the system, and know that this curiosity, or use belongs to this, or that object, when it happens to come in our way.

§. 15.

If man was created to give praise to his Creator; if the Creator has made himself known to man by revelation, and creation; if all created things are formed with wonderful mechanism; lastly, if all things were created for the use of man, and nothing but natural things, and the elements can be of use to him; then it may be inquired with the same reason, to what end any other thing was created, as well as man; the supreme Being having created nothing but for a certain end, and for some valuable purpose. We are often ignorant what that purpose is, but it would therefore be impious to say, that any thing was created in vain, since he declared that every which he had created was good. Gen. i. 31.



O B S T A C L E S
T O T H E

Improvement of P H Y S I C.

B Y

JOH. GEORG. BEYERSTEIN.

Amænitat. Academ. vol. 2.

P R E F A C E.

Although phyfic in its whole extent has received great improvements in this age, as most of its parts have been diligently looked into and reformed; yet its chief strength seems to consist in accurate knowledge of diseases, and medicines, and when we turn our eyes on the present times, we find that many simple medicines have been neglected; which so little deserve it, that they rather ought to be revived, and brought into practise. Which being the

case i have frequently endeavored to find out the cause of this common ignorance. The result of my inquiries i submit to the judgment of the candid reader in this academical exercise, which, though far from compleat, is the best i could produce, and i hope it may prove of some use, and meet with a favorable reception.

Various causes have concurred to bring many medicines into neglect.

I.

Fashion which prevails in physic, as it does in every other earthly thing. Hence physicians prescribe according to certain received forms, not sufficiently considering, whether the success answers. To this must be referred the frequent change of remedies.

Brooklime, borrag, bugloss, plantain, saxifrage, are properly only kitchen plants. Comfrey is scarcely of any use, but to adulterate syrup of violets, for which purpose it ought not to be used. Bugle, motherwort, eye-bright, poley-mountain of Crete, are kept in shops more from custom, than for any good, and sufficient reasons. On the other hand the bear-berry has been neglected, though an efficacious astringent. The grass of Parnassus, and sundew, have crept into the shop by chance. The carline

fine thistle, an excellent remedy in hysteric complaints, is neglected! Those poor wretched plants the vervains increase the number of officinals without any merit of their own, and only supported by the testimony of antiquity.

2.

The many theories and hypotheses of physicians that vary in every age. For men have been vain enough to imagine that they knew the immediate causes of diseases, the manner in which medicines operate, and from their principles have undertaken to deduce the virtues of medicines.

Formerly hot and volatile medicines were used in acute distempers. At present the acid, cooling, and diluting with bleeding are recommended. Musk, ambergris, civet were looked upon as most efficacious in eruptive fevers, now just the contrary. And thus meadow-sweet, woodruff, musk cranés bill, may in their turn come into credit, which now are seldom used for driving out these eruptions; though we may be assured of their virtues by undoubted experiments long since made,

3.

The neglect of specifying distempers. Hence remedies, which are excellent for some diseases in one man; nay even those very remedies that get

the same of specifics on account of some very remarkable virtue, when administered to another, are either of no service, or even do mischief; whereas they would perhaps never fail of a good effect, if the species of the distemper were the same. Therefore till physicians regulate the doctrine of diseases in the same manner, that botanists have done that of plants, medicines must be necessarily precarious.

Were any one to set about curing the hæmorrhoidal colic in a plethoric constitution by spirituous and hot carminatives, which are proper for the flatulent colic in a cold, and phlegmatic constitution, he would soon find most fatal proofs of his error. Of this a very remarkable instance may be seen in *diff. med. dni. Arch. Bæck. de medicam. domest.*

An hasty and imprudent judgment about poisons, and their difference from medicines, which in reality differ only in degrees of strength. Hence our ancestors scarcely ever dared to prescribe the use of plants, which they imagined to be poisonous.

The laurel is neither used in consumptions, nor venereal complaints, though an excellent remedy; because it is suspected to be poisonous. The pasque flower, whose root is very efficacious in hysteric complaints, is

gone

gone out of vogue; because Helvigi-
 us knew a person who dyed upon using a syrup
 made of it; as if all inebriating drinks were
 to be discarded, because some have lost their
 senses, and lives by an inordinate use of
 them. The *lignum colubrinum**, that is
 famous in venomous bites, and the quartan
 ague, is neglected for the same reason.
 Scarce any one dares recommend the use of
 the mandragora, although Schopperus has
 shewn its vertues in the gout. The deadly
 night-shade is not yet brought into practise,
 though we have great reason to expect much
 from it in dispersing tumors of the breast^r.

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* In vol. 2. *Amen. academ.* there is a treatise on the
lignum colubrinum, in which the author undertakes to de-
 termine from what plant this root is taken, and observes that
 druggists, for want of a proper description, have confounded
 it with two other plants, one of which, and that generally
 found in the shops, is of a poisonous nature.

I cannot omit saying a word or two on the subject of the
 deadly nightshade on this occasion, as the trial of it caused
 so much noise in this town some time ago. I know the
 generality of people look on its fate as decided, and that it
 is destined never to revive again, but that is not clear to me.
 Some of the faculty still entertain a good opinion of it, and
 have seen some benefit done by it. Antimony was once en-
 tirely discarded out of physic, yet we have seen it since be-
 come one of the most fashionable remedies in many diseases.
 New medicines, and particularly of so strong a nature as the
 night-shade, do not come at once into vogue. The
 not being able to ascertain the proper manner of giving
 it, the uncertainty in what cases it ought to be used, and
 how to obviate the inconvenience attending its use, not to
 mention

The abuses of quacks, and their bold, and dangerous experiments. These have made many patients averse to some of the most celebrated medicines, insomuch that a physician dares not prescribe them. For some timid injudicious friend is always at hand to impose upon their weakness, and let them know, that they are going to take a remedy, which had proved fatal to others; not considering that it was owing to the wrong application, and not to the nature of the remedy.

The hellebore formerly cured many deplorable distempers, but by the errors of quacks, and their immoderate doses, it has so happened, that it is fallen into disuse; but the wild cucumber and bitter apple are beginning to revive again. The bark of the berry-bearing alder is a very excellent purge, yet physicians have been almost afraid to prescribe it, and perhaps terrified by the ill success of those daring men above-mentioned, who gave too large doses of it.

mention many other reasons; these, I say, joyned together, are fully sufficient to overturn a medicine of the most promising appearance for a time. But whatever may be the fate of the night-shade itself, the disinterested zeal of my worthy friend Mr. Gataker to find out some remedy for the most dreadful, and desperate of all diseases, and the candid manner, in which every circumstance, relating to that affair, was communicated to the public, must entitle him to the esteem of every humane person.

Many

Many of the moderns for a long while dared not make use of opium even externally.

6. *The timidity, and caution of physicians lest they should hurt their patients by violent remedies.* For which reason they give rather mild, than efficacious ones, and act the part of spectators, rather than physicians.

For this reason perhaps the disciples of Stahl reject the bark, though from ignorance of botany they use the cascarilla, which is certainly a very good medicine in shiverings, but not totally void of malignity. Physicians did not for a long while presume to prescribe the wild cucumber, which is indeed pretty violent, but by no means so terrible, that it ought not to be used even in the dropfy. For the same reason they did not venture to use the squill, whose virtue is very great in thinning viscidities, viz. because they did not know the proper dose of either of them. The gamboge is neglected, though the Turks have taught us its efficacy in a quartan; and the experiments of our president in the hospital at Stockholm have confirmed their practise.

7.

Small doses of physic. For while physicians have been over cautious in their prescriptions, they

they have fallen into the inconvenience of doing the patient no service; and to confess the truth, i suspect they more generally err this way at present; while they order drachms of plants for an infusion, where ounces would be more proper. On the other hand mountebanks, and quacks, men of an intrepid mind, and invincible impudence, oftentimes make a cure, when the physician of probity fails.

If any one were to prescribe only two grains of rhubarb for a purge, he might as well do nothing at all. The honey-suckle is used in decoctions, but not in the quantity necessary; for which reason its virtue in purifying the blood is known but to few. The dose of the china root ought to be large, or no good can be expected from it in venereal cases. Those remedies which are sought for amongst vegetables for curing the venereal disease are perhaps given more sparingly, than they ought.

.8.

The ignorance of apothecaries in botany, who often sell one plant for another; by which means, when the desired effect is not obtained, the physician is deterred from the use of them for the future.

For rad. hermodact. which is recommended in the rheumatism, the apothecary sometimes gives

gives the root of the meadow saffron; sometimes of one of the irises, which differ from it in virtue. Hence the effect of the physician's prescription being uncertain, he is at last obliged to give it up entirely. For the scabious they give the centaury Fl. Suec. 708. For the brankurline, the cow-par-
 shep; the root of the toothwort, which is excellent in the tooth ach, is neglected, because the apothecary does not know, whether it ought to be taken from the toothwort 563, or 518, or some other plants. Instead of the root of the burnet saffrage, which is a good astringent in the hæmorrhage, the root of the burnet is wrongly substituted. To this may be referred the mistake of selling the St. John's wort 624 for the St. John's-wort 625, which is vulnerary and good in worm cales.

9.

The ignorance of physicians in botany, or their want of care to reject useless, spurious and improper succaneums.

We suspect that this formerly was the case; but now, that the knowledge of botany is carried so far, we have reason to hope, that things will go better. The acmella which is very serviceable in the stone, since it is extremely rare, and dear, is to be supplied
 out

out of those plants which are really akin to it. This choice belongs to the botanist: for which reason our president has obliged the world by informing it, that the figesbeckia, as nearest allyed to the acmella, may be rightly substituted in its room*; which Dr. Hasselquist has confirmed by an experiment made here at Upsal upon a young man afflicted with the stone. The skilfull in botany will easily judge that the German leopard's bane, as well as the common, carries suspicion of poison; yet the former has been looked on as harmless by those, who were ignorant of botany, and the latter dangerous. The daisy is cried up in vain on account of the excellent vertue it is supposed to possess. Practitioners, unless they be skilfull in botany, will scarcely allow the wild rosemary to be a most efficacious remedy against the hooping cough; which yet is commonly used in this disease by the Westrogoths. The Turkey baum is kept in our shops, altho' much weaker than the Canarian, which is excluded. The white faxifrage and dropwort, tho' neither of them has any extraordinary quality, yet

* Vid. *Amœnit. academ.* vol. 2. p. 151. where some succedaneums to the Senega root are mentioned, founded on the same principles.

hold a place amongst our officinals. The mechoana is seldom used, as being of no great strength, yet it is a very proper purge for infants. The oak of Jerusalem is gathered from the European plant, whereas both taste and smell instruct us, that we ought to get it from the American, as a most powerful remedy in consumptions. The plant, and stalk of black currants, no contemptible medicine in the hydrophobia, in feverish dysenteries, and other contagious distempers, are now neglected, as the antients have said nothing about their virtues; which yet are discoverable by the smell, tho' not by the taste.

10.

The use of compound medicines. Simples are so very rarely used, that the virtues of plants are not known for want of experience.

It is scarcely necessary to produce instances of this assertion. Whoever turns over the writings of the antients will be astonished at the prescriptions, or rather indexes, in which numberless things are mingled together. This affair ought to be looked into, and regulated; that we might not fall under the lash of some future Serenus Sammonicus, who might address himself thus to some physicians:

Ye

Ye jumble in one mass such costly juices;
So various in their natures, in their uses,
That the poor patient, who relies upon you,
At once is cheated of his health, and money.

11.

The mixing things together of a different nature. For oftentimes many things are confounded together, which separately administered might assist the patient, and give credit to the physician; whereas mixed they become useless, one destroying the effect of the other.

Thus watery mixed with dry, viscous with saline, glutinous with stiptical, sweet with acrid, acid with bitter, sapid with nauseous, mutually weaken each other. *

12.

The ignorance of the natural classes. From hence it happens that we cannot form any judgment, conformable to botanic principles, of one plant

* I cannot help applying to this and the foregoing section two verses of that sensible old poet, economist, and husbandman Hesiod, tho' in a different sense from what he uses them.

Νόστις ἢ ἴσασιν ὅσον πλεον ἡμῶν παρ' ὅσους
οὐδ' ὅσον ἐν μαλάχῃ τε καὶ ἀσφοδέλῳ μεγ' ὄνειαρ.

Which I shall translate for the sake of the unlearned reader. The meaning is as follows. " Foolish man does not know how much the half is more than the whole, and what great benefit may be found from the plants, that grow every where about us."

from

from the knowledge of another. And thus we are afraid of proposing any uncommon plant, being doubtful what we ought to expect from it.

Dogs mercury has been given internally, for want of knowing the natural classes; whereas he, who is qualified to reason about the vertues of plants, will allow only the external use of this plant, and in glysters. The cow parsnep has been ranked amongst the emollients, although not one among all the umbelliferous kind, that i know of, is famous for this quality. The people of America ought to give the mitreola Hort. Cliff. for the bite of serpents instead of the ophiorrhiza, which if they were to do, they would hardly ever fail of success, if botanists be not greatly mistaken.

13.

The neglect of vulgar medicines easily to be procured. For we owe the very best of our medicines to the vulgar, who have been taught the use of them by necessity, and conceal them as secrets.

We learned the use of the mezereon in the cancer from the countrey people. The noble liverwort is reckoned a specific in hypochondriac affections by the Gothlanders. The linnaea is commonly used by the Ostrobothnicians in gouty pains. The common
people

people use pepper oftentimes very injudiciously in acute distempers, in eruptive fevers under certain circumstances very rightly. The countrey people taught us the vertues of the thrush-moss for sore throats; of the hop in dislocations; and of the tremella, Flor. Suec. 1017. for fixed pains in the joynts. They also chew, and blow the fumes of garlic into infants to assuage their gripes, or bruise, and apply it to the navel by way of poultice.

14.

The neglect of travelling out of Europe. Which would afford us an opportunity of knowing plants, familiar to forreign nations. And I see not why we should be ashamed of learning any thing useful from Barbarians.

It is not long ago that some botanists, who went to America, discovered to us those excellent medicines, the great water-dock in the worst scorbutic cases, the monarda in intermittents, the collinsonia in the colics of lying-in women, the lobelia, the ceanothus, the diervilla in venereal cases, the senega

Ullua observes that some diseases at Carthagena are become fatal, which formerly were not so. Which he attributes to the neglect of the Indian remedies. For he says the old women even now sometimes cure the chapetonade, which is one of the distempers he mentions, and formerly never failed to cure it.

root and ophiorrhiza against the bite of serpents and burning fevers. The celebrated Kalm very lately let us know, that the water avens is looked on as a succedaneum to the bark by the people of Canada. The water figwort that corrects senna, the bark, &c. were communicated by the Barbarians.

15.

The neglect of reading botanical writers, especially those, who in these latter times have faithfully set forth what they knew, by certain experiments concerning the virtues of plants.

Of this kind are Rheede, Sloane, Feuillee, &c. the use of the coris is unknown to most people, who have not seen what Shaw says on that subject. The virtues of the stalks of the bitter-sweet purifying the blood were a secret, till our president brought them to light. Before him the apothecaries gave only the garden night-shade, or the leaves of the bitter-sweet, yet few here have found any good effect from them; as we have rarely given this remedy in sufficient doses. The rest-harrow is seldom prescribed, because physicians have not learned its virtues in the Hungarian fever from Scyller. The antients recommended the cotton-thistle in cancerous cases, but from
N neglect

neglect of reading the antients, this specific is almost forgot.

16.

Neglect of a method in exhibiting medicines. For instance, physicians expect those virtues from a dried plant, or in a decoction, which is not to be found but in the fresh plant, or from its expressed juice. Hence it may justly be expected from apothecaries, that they set about cultivating plants; that such, as ought to be used fresh, may be had daily from their gardens.

The hedge hyssop, when fresh, purges very smartly, and vomits; when old it produces no effect at all. The diuretic virtue of our water flag, which is very considerable, when the plant is fresh, entirely goes off, when it is kept long. Therefore we ought to expect this virtue from the expressed juice, and not from a decoction of it. The stone crop, when dry, has none of that efficacy in the scurvy, which is found in it, when fresh. The same be said of the house-leek, the juice of which is celebrated by the Hortentots. The radish, the scurvy-grass, the horse radish, the garden, water, and Indian erefs, and the all-sawce, ought to be sold in the shops fresh, and not dried; in order to be of any service in the scurvy. The recent root of the rose-wort is vastly superior to the

the dry in head-achs. Besides it ought carefully to be considered in what part of the plant its vertoe resides. Thus it is the juice of the poppy, that spreads over the brain, as it were, a Lethcan drowiness, and not the seeds, for these are eatable. The sagacity of the moderns has reduced the immense number of distilled waters to a very small list.

17.

Neglect in cultivating plants. Hence apothecaries are necessitated to sell plants which they have had by them many years, and which have lost all their virtues.

The spikenard is more durable perhaps, than any other plant; for it will keep its fragrance above an age, as appears by Burserus's Herbarry. But other plants are very different in this respect. e. g. the root of ginseng, tho' a great restorative, being so very costly, is seldom prescribed; and when it is, it generally has lost its properties thro' age. For which reason we ought to contrive methods of cultivating it ourselves. Instead of the leaves of the true marum, which has not its equal in art, or nature, the mouldy stalks of it are generally found in apothecaries shops. But we would not be understood as if in all cases we prefer the cultivated plants to the wild ones. On the

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17.

Neglect in cultivating plants. Hence apothecaries are necessitated to sell plants which they have had by them many years, and which have lost all their virtues.

The spikenard is more durable perhaps, than any other plant; for it will keep its fragrance above an age, as appears by Burserus's Herbarium. But other plants are very different in this respect. e. g. the root of ginseng, tho' a great restorative, being so very costly, is seldom prescribed; and when it is, it generally has lost its properties thro' age. For which reason we ought to contrive methods of cultivating it ourselves. Instead of the leaves of the true marum, which has not its equal in art, or nature, the mouldy stalks of it are generally found in apothecaries shops. But we would not be understood as if in all cases we prefer the cultivated plants to the wild ones. On the

contrary the vipers grass, the goats beard, the succory from the fields are superior to those which the industry of the gardener has rendered more delicate, on account of the medicinal bitter, which is wanting in their cultivated state. See a catalogue of such plants as may be raised with us in Linn. Mat. Med. p. 212.

18.

The ignorance of physicians and apothecaries in relation to our own plants. From whence it happens that they are obliged to procure plants from abroad, which may be had at home.

Thus our people buy the root of the rosewort and root and seeds of the garden angelica collected by the Norwegians on our alps, and sold by them to foreigners. For the rest see a catalogue of such plants, as are natives of our country, in Mat. Med. above cited, p. 210. If a purge or any other slight medicine is prescribed to a poor country fellow, it must be the produce of the Indies, so that they cannot afford to purchase it. Hence people abhor the thoughts of employing a physician or an apothecary.

19.

The ignorance of many foreign plants. Hence we are uncertain whether those which are brought to us be genuine or spurious; and hence also their

their genera being unknown, we are uncertain about their vertues.

To this head may be referred the sea lavender, the myrobalan, the starry anniseed, the balsam of Copaiva, the balsam of Peru, the gum animæ, caraunæ, elemi, the gum rosin of myrrh, bdellium, sagapenum, the aloes wood, calambac.

20.

The usual custom in apothecaries shops of providing only drugs of quick sale. Thus they will not procure some whose vertues are now-a-days well known, for fear they should lye upon their hands. It is the business therefore of the physician who has any regard for his own reputation, and the patient's welfare, to require the apothecary to procure such plants, as he thinks may be usefull.

Simorouba an excellent remedy in the dysentery, the senega root in venomous bites, the profluvii cortex in the diarrhæa, the camphrata in the green sickness, the auricularia in deafness, the Peragua in the diabetes, the south sea tea in the small-pox, the serpentum radix against venomous bites, the wild flax, a very usefull purge, are neglected. The juice of the hypocistis, and fungus melitenis, altho' powerful medicines in hæmorrhages, and the herba dysente-

rica, which is named so from its peculiar virtues, have not yet got a place amongst our officinals.

21.

Want of care in gathering simples at a proper time, and keeping them, when gathered, in a proper manner.

The root of the avens, unless gathered in the beginning of the spring, before the sap by nourishing, and pushing out the leaves, has wasted its aromatic virtue, will by no means answer what may be justly expected from it. Rhubarb ought not to be brought into an apothecary's shop under ten years from the time of its gathering. The flowers of the St. John's wort ought to be gathered before they are full blown, that their balsamic virtue may be preserved. The root of the angelica is good for nothing unless it be gathered in the winter. Sloes ought to be gathered before they are ripe, and the juice pressed out of them in this state, i. e. before the harshness is softened by the frost, if it be designed for an astringent. Marum ought to be kept in vessels well closed, lest the volatile part, in which its virtue resides, should evaporate.

Still

— Still an ample field remains,
But not for me, to others i give way,
Who choose a longer course.

AS i do not pretend to understand the subject of this piece, and therefore cannot say how far the obstacles to the advancement of physic charged upon the Swedes subsist in this countrey, or whether all those obstacles, which the author has mentioned, be real or not, my sole motive for translating it was to draw it out of that obscurity in which it was buried amongst many other pieces, relating to curiosities of natural history. I think i may be allowed to say a piece is buried in obscurity, which is only known to a few, who happen to be in the way where such curiosities are talked of, and an attempt to spread it over the nation cannot but be right, if the doctrine be solid, and affects our practitioners.





**T H E
S W E D I S H P A N.**

**B. Y
NICOLAS HASSELGREN.**

Upsal, 1749. Decem. 9.

Amænit. Academ. vol. 2.

§. 1.

THE antients attributed the pastoral life to Pan, the care of flowers to Flora, hunting to Diana, and the cultivation of grain to Ceres. We, tho' acknowledging only one Deity, who governs all things, yet often use these names to denote the subject we undertake to treat upon. What word is now more known among botanists

botanists than the word *Flora*, by which they mean all those plants, which grow within a certain compass of ground, as our *Fauna Suecica* takes in all those animals, which are natives of Sweden. For a like reason we have entitled this small tract the *Swedish Pan*, intending thereby to denote the five domestic quadrupeds, which live upon plants growing in Sweden; or the devouring army of *Pan*, which lays waste the provinces of the *Swedish Flora*. We choose by this means to avoid a prolix definition, which is always disagreeable for the title of a book.

§. 2.

The pastoral life, by the testimony of both sacred, and prophane history, is nearly as old as man himself; so that i would willingly derive the knowledge, which i am going to deliver, from the most ancient times; but altho' plants have been constantly obvious to the eyes of every man, yet i am obliged to declare, that we have nothing delivered down to us in any book concerning the kinds of plants proper for the different kinds of cattle; so that i may be sure of not disgusting my reader with stale matter new dressed up. For the whole of what i present to him is new.—Our illustrious president in his journey thro' *Dalecarlia* ann. 1734, made the first attempt this way, as may be seen *Flor. Lapp.* p. 158. where he says thus. ' In my journey thro' *Dalecarlia*, where

we

' we climbed up the mountains, and were got
 ' into Norway, my fellow travellers being tired,
 ' and asleep, i wandered about in a dismal wood,
 ' and perceived that the horses easily distinguish-
 ' ed wholesome from noxious food; for being
 ' very hungry, they devoured all sorts of plants,
 ' except the following; meadow-sweet, valerian,
 ' lilly of the valley, angelica, loose-strife, marsh-
 ' cinquefoil, cranes bill, hellebore, monks-hood,
 ' and many shrubs. This gave me a hint to re-
 ' commend to the curious, that they would fer-
 ' about examining what plants such animals, as
 ' live on vegetables, viz. the cow, the sheep, the
 ' goat, the stag, the horse, the hog, the monkey
 ' and their species will not touch. An examina-
 ' tion which would not be without its use, were
 ' it properly made.' Notwithstanding this re-
 commendation no enquiry was made, till our
 president returned home from his travels thro'
 foreign countries, and made a progress thro'
 our own provinces. Afterwards professor Kalm,
 that worthy disciple of so great a master, follow-
 ed his example; so that in his journey to Bahus
 we find mention made of some plants, which
 cattle either eat, or refuse. Ann. 1747 and
 1748 our president undertook with great dili-
 gence not only to make experiments himself, but
 to excite his disciples, and auditors to do the
 same; of which number i was one. Thus at
 last

last many experiments were made, and repeated, especially by D. D. Hagström, Mag. E. G. Liedbeck, E. Ekelund, J. G. Wallboom, L. Montin, F. Oldbers, J. C. Forskall, A. Fornander; not to mention others, who strove, as it were, to out do one another in finding the plants, which were suitable to different animals.

§. 3.

The difficulty however of examining all the Swedish plants, and getting animals proper for experiments, which ought all to be repeated, has hindered us from being able to give a compleat work on this subject. But the greatest part, and the most common vegetables of Sweden being now determined by us; what is wanting may be supplied from time to time. We hinted that animals proper for experiments which ought to be taken from among cows, goats, sheep, horses, and swine, are difficult to be found, for these reasons; first, because some plants are eat by them in the spring, which they will not touch all the summer; when they are apt to grow rank in taste, and smell, and become stalky and hard. Thus many people eat the nettle in the spring; but who could bear it afterwards? Again, because some kinds of animals eat the flower, and will not eat the stalks; others eat the leaves and will not eat the stalks. N. B. When they eat the leaves, we say in general they eat the plant, otherwise

wife there would be few grasses they could be said to eat. Next, the animals ought not to be over hungry, when we make our experiments, if we intend to make them properly. For they will greedily devour most kinds of plants at such a time, which they will absolutely refuse at another. Thus when they come immediately out of the house, they are not fit to make experiments upon; for then they are ravenous after every green thing that comes in their way. The best method is to make the experiments when their bellies are almost full, for they are hardly ever so intirely. Moreover the plants ought not to be handled by sweaty hands, some animals will refuse the most pleasing, and tasteful in that case. We ought to throw them on the ground, and if we find the animal refuses to eat them, we must mix them with others that we know they like; and if they still refuse them, we have a sure proof, especially if the same be tryed with many individuals.

§. 4.

Our views do not extend beyond the Swedish plants, and that for the sake of our own oeconomy. Let foreigners look to that part which concerns themselves, and thus our work will be confined within moderate bounds. We can produce above 2000 certain experiments, some of which were repeated ten times over, some twice

as

as often. If we take the *Flora Suecia Holm.* 1745. and put to any herb the generical name, adding the number, and some epithet by way of difference, our work will be very much abridged.

§. 5.

It is manifest that the vegetable world was intended for the support of the animal world, inasmuch that altho' not a few animals are carnivorous, yet these animals which they devour cannot subsist without vegetables. In this speculation we behold with admiration the wisdom of the Creator, which has made some vegetables absolutely insipid to some animals that live upon plants, when these plants are agreeable to others. And there are plants, which are poisonous to some animals, which are very wholesome to others, and on the contrary. This did not happen by chance, but was contrived for wise purposes. For if the Author of nature had made all plants equally grateful to all kinds of quadrupeds, it must necessarily have happened, that one species of them being remarkably increased, another species must have perished with hunger, before it could have got into better pasture; the vegetables being consumed over a large tract of ground. But as it is ordained every species must by force leave certain plants to certain animals, so that they always find something to live upon, till they meet with better pasture; in the like manner we find it contrived

trived in relation to the plants themselves, which do not all grow in the same countrey, and climate; but every plant has its place appointed by the Creator, in which it grows more abundantly, than any where else. From hence we may observe, that those animals, which chiefly live upon particular plants, chiefly abound in certain places. Thus the lichen or liverwort, Fl. 980. is found in greatest plenty on the cold alps, and therefore the rein deer, which all winter live mostly upon this plant, are obliged to live there. The festuca^a Fl. 94. which flourishes and spreads most on dry pastures, draws the sheep thither, which above all things delight in that kind of grass. The seeds of the dwarf birch, which afford the best sort of food to the rough legg'd partridge, and the Norway rat, tempt them to dwell in these northern parts of the world. Camels hay, which above all plants, grows on loose sand, draws the camel to choose those barren places, as they there find food most agreeable to them; not to mention many other similar instances. Trees, whose heads shoot up so high, that quadrupeds cannot easily reach them, afford nourishment for that reason to more numerous tribes of insects, as the fallow, the oak, the pear, &c. The Creator, who most wisely established this law, has as it were imprinted it on the organs of animals, that they might not offend

^a A grass which has no English name.

against it thro' ignorance; and as every transgression has its punishment allotted, so also no offence against the law of nature can escape. Animals, which violate this law are punished by diseases or death; and hence we behold with admiration that brutes, which were designed to be guided by instinct, can by no means whatever be prevailed upon to act against it. If by chance it happens that any animal offends this way, and suffers for it, we vulgarly say it has taken poison, so that ignorant people wonder, not to say murmur at the wise disposition of the Creator, who has produced so many noxious plants; but without sufficient reason, for no one plant in the world is universally poisonous, but all things are good, as they came from the hands of the Creator. Physicians often mention that this or that plant is deadly, because its particles are of a nature apt to wound the fibres of the body or corrupt the juices. But this is only respectively to the species of animals, e. g. the sun-spurge has a milky juice, which causes blotches in our skin and hurts our fibres, and therefore it is said to be poisonous; yet the moth almost entirely lives upon this plant, and prefers it both for taste and nourishment to all others, as it thrives best upon it. Thus one animal leaves that, which is poisonous to itself, to another animal, which feeds upon it deliciously. Long-leaved water hemlock will

will kill a cow, whereas the goat browses upon it greedily. Monks-hood kills a goat, but will not hurt a horse; and the bitter almond kills a dog, but is wholesome food for man. Parsley is deadly to small birds, while swine eat it safely; and pepper is mortal to swine, and wholesome to poultry. Thus every creature has its allotted portion. Animals distinguish the noxious from the salutary by smell and taste. Younger animals have these senses more acute, and therefore are more nice in distinguishing plants. An empty stomach will often drive animals to feed upon plants, that were not intended for them by nature. But whenever this has happened they become more cautious for the future, and acquire a certain kind of experience, e. g. the monks-hood, which grows near Falhuna is generally left untouched by all the animals, that are accustomed to these places; but if foreign cattle are brought thither and meet with this vegetable, they venture to take too large a quantity of it, and are killed. The cattle that have been reared in the plains of Scania, and Westrogothia, commonly fall into a dysentery when they come into the woodland parts, because they feed upon some plants, which cattle used to those places have learned to avoid. In

* The same thing has been told me by the country people in Herefordshire in relation to meadow-saffron, which grows in plenty in some parts of that county.

the spring, when the water hemlock is under water, so that the cows cannot smell it, they dye
 :. in heaps. But when the summer comes on and has dried the ground, they are very carefull not to touch it. It is also true, that all vegetables prohibited by nature to particular animals are not equally pernicious, and therefore though through necessity and hunger they eat them, yet they do not immediately dye, but it is certain that they cannot have from thence good and proper nourishment.

§. 6.

The end of this kind of knowledge is not bare curiosity, although were this the case every part of knowledge, which sets forth the stupendous works of the Creator, is never to be looked upon as of no consequence. On the other hand we do not pretend to gain any medicinal advantages from these speculations, namely, to be able from hence to conclude, that this or that plant is noxious to man, because it is so to this or that brute animal. Nor do we for that reason approve of Wepfer's experiments upon dogs, and other animals, as if any knowledge can be thence gained in regard to man. No, the end we aim at is merely œconomical.

α. From these experiments we may know whether certain pastures afford good nourishment
 O for

∴ See page 227.

for this or that species of animals. We see e. g. heifers waste away in enclosures, where the meadow-sweet grows in abundance, and covers the ground so that they can scarce make their way through it; the countrey people are amazed, and imagine that the pasture is too rich for them; not dreaming that the meadow-sweet affords them no nourishment. Whereas the goat, which is bleating on the other side of the hedge, is not suffered to go in, though he longs to be browsing upon this plant, which to him is most delicate and nourishing food.

β. From these experiments we may almost be sure by affinity and analogy, whether meadows or pastures are salutary or noxious to particular animals; e. g. long experience has taught us that our sheep take up poison in marshy grounds, though no one till lately knew what was the particular poison. Yet the spiderwort 267, the mouse-ear scorpion grass, the mercury, the sun-dew, the hairy wood grass, the lesser spearwort, the butterwort, have evidently suspicious marks*. I will therefore propose a new

* There is great reason to think that what makes low grounds so noxious to sheep is not the moisture, but the plants that grow there. For it is observed by shepherds that the great danger to sheep is immediately after a fresh spring of grass, which i imagine is owing to their licking up the young and tender shoots of poisonous plants, along with their proper food, not being able to distinguish them.

experiment.

experiment. The andromeda is known to be a most rank poison to sheep in Virginia. The andromeda, called by the people of New York dwarf laurel, Cold. Act. Upsal. 1743. p. 123. is very fatal to the sheep in New York. These two plants are of a different species, but of the same natural genus, and therefore have the same vertues. Amongst us, especially in the northern parts, the wild rosemary grows every where in marshy grounds, which being of the same natural genus with the foregoing, we may reasonably conclude that it destroys our sheep. To this we may add, that it is on account of three other species of andromeda, which grow on the Lapland mountains, that the sheep there never are healthy, and lastly although the cistus ledon is not a species of andromeda, yet being of the same natural class, it is not unlikely but that this plant is far from affording good nourishment to sheep. This conjecture gives our shepherds an unexpected opportunity of making experiments with their sheep, and indeed they cannot omit to do it without being justly blameable, since on this the health of their whole flock depends. It is particularly to be noted upon this occasion, that the botany of America, a countrey so far disjoyned from us, gives a hint for considering things of the greatest use, of which the antients did not so much as dream.

γ. From hence the œconomist may truly judge of his meadows, and know that some are vastly preferable to others for certain animals. For although cattle, pressed by necessity and hunger, will feed upon vegetables less gratefull to them, yet it is not to be doubted but that they are not equally well nourished by these as by others. Thus the Dalecarlians are obliged in a scarcity of wheat to support themselves by bread made of the bark of the pine, yet it does by no means follow from hence that this affords proper nourishment. We see that horses in time of war, when pressed by extreme hunger, will eat dead hedges, but we cannot hence conclude, that wood is good food for them.

δ. The industrious farmer may judge from hence, when he sows his meadows with hay seeds for pasture, that it is not indifferent what kinds of seeds he choofes, as the vulgar think. For some are fit for horses, others for cows, &c. Horses are nicer in choosing than any of our cattle; siliquose and filiculose plants particularly are not relished by them. Goats feed upon a greater variety of plants than any other cattle, but then they chiefly hunt after the extremities and flowers. Sheep on the contrary pass by the flowers and eat the leaves. Not to mention the different disposition in different animals as to grazing

ing near the ground or not. The countreyman who understands these things, and knows how in consequence to dispose of his grounds, and assign each kind of cattle to its properest food, must necessarily have them more healthy and fat, than he who is destitute of these principles. The good œconomist will observe the same of his hay. For although many herbs, when dry, are eat, which when green would be refused, it does not follow from hence that they yield good nourishment. Much might be added concerning the propension of cattle to this or that plant, which the compass of this small tract will not admit of; e. g. that sheep above all things delight in the festuca, 95. and grow fatter upon it than any other kind of grass; that goats prefer certain plants, but being led by an instinct peculiar to themselves, they search more after variety, and do not long willingly stick to any one kind of food whatever. That geese are particularly fond of the seeds of the festuca, Fl. 90. That swine are excessively greedy after the roots of the bull-rush while they are fresh, but will not touch them when dry; hence it appears that it is in vain to contrive engines to extract the roots of the bull-rush out of the water, and dry them for the use of these animals in winter.

That these animals spoil the meadows, where the scorzonera grows, in order to come at its root, which they delight in, and also the fields, to get at the roots of clowns-all-heal. The husbandman imagines they do good to his fields by ploughing the ground and eating the roots of couch-grass, whereas they never touch them, but when pressed by the utmost necessity^d.

§. 7.

To give a view of my design in a few words. I have disposed the plants mentioned in the *Flora Suecica* according to their numbers, and to be as short as possible, it was necessary to add the generical name with a short and incomplete epithet, which however may be illustrated out of the

^d In the same way with us it is a notion that prevails commonly that cows eat the crow-foot that abounds in many meadows, and that this occasions the butter to be yellow, from whence I suppose it is generally known by the name of the butter-flower. But this I believe is all a mistake, for I never could observe that any part of that plant was touched by cows or any other cattle. Thus Linnaeus observes, *Fl. Lapp.* p. 195. that it was believed by some people that the marsh marygold made the butter yellow, but he denies that cows ever touch that plant. Yet he thinks that all kinds of pasture will not give that yellowness, and then observes that the best and yellowest butter he knows, and which is preferred by the dealers in those parts to all other butter, was made where the cow wheat grew in greater plenty than he ever saw any where else. This shews how very incurious the country people are in relation to things they are every day conversant with, and which it concerns them so much to know.

Flora itself. I have distinguished the cattle against every plant into five columns. The first of which contains oxen. The second goats. The third sheep. The fourth horses. The fifth swine. By the mark (1) i have denoted those plants which are eaten; by the mark (o) those which are not eaten; by both together those which are sometimes eaten, sometimes refused; or are eaten when cattle are more used to them, and are more hungry, otherwise not.

§. 8.

Upon the first view of this subject the reader will perceive, that it is not treated compleatly, so that every Swedish plant is pointed out, and by what animals it is eaten. What generally happens upon turning up old lands, viz. that for the first years it cannot be cleansed from all useless weeds, and be laid down fine like a garden, but will here and there have rough tumps and hard clods, unless we will let it lye fallow for a very long time; the same or something like it has happened upon this occasion.

I am apt to believe however that the reader will be better pleased that i have opened this new scene, than if i had waited longer in order to gain farther light. For since there are many people here curious in botany and œconomy, i hope they will all lend a helping hand, that i

may one day be enabled to give a more compleat edition of this piece°.

• After this in the original follows a long table of experiments, of which i shall only give a small specimen; as the whole would increase the bulk but not the value of this piece to such readers as this translation is intended for, since they would neither know the plants by the names the author has given them, nor by any i could put in their room. However i shall for curiosity give a specimen, and add the general result of his experiments, just as he has marked it at the end of his table; which is as follows. 'Thus far,' says he, 'we have given 2314 experiments. From these it appears that

Oxen eat	276	refuse	218	plants
Goats	449		126	
Sheep	387		141	
Horses	262		212	
Swine	72		171	

• And thus these animals leave untouched 886 plants.

• These animals will not eat any kind of moss. The goats are very fond of the alga.

• Some of them greedily devour the fungi, others will not taste them. But we recommend farther trials in relation to these animals.'

Then follows an account of some trials made by Dr. O. Hagstrom to the same purpose in relation to rein deer, but as they no ways concern us, i have omitted to mention them.

N. B. For the table i have chosen not to take such plants as occurred first in my author, but to select the grasses of our own countrey, and have given English names to them of my own invention, the reason of which will appear in the following observations.

		O.	G.	S.	H.	Sw.
Spring grafs	_____	1	1	1	1	
Mat grafs	_____	10	1	1	1	0
Canary grafs, reed	_____	1	1	1	1	0
Cats-tail, meadow	_____	1	1	0	1	0
Fox-tail, meadow	_____	10	1	1	1	10
_____ water	_____	1	1	1	1	0
Millet grafs	_____	1	1	1		
Bent grafs, silky	_____		1	0	1	
_____ fine	_____	1	1		1	
						Hair

Hair grass, small leaved	_____	I	I	I	I
_____ water	_____	I		I	I
Poa grass, creeping	_____	I	I	I	I
_____ annual	_____	I	I	I	I
_____ broad-leaved	_____	I	I	I	I
_____ narrow-leaved	_____	I	I	I	I
_____ common	_____	I	I	I	I
Cocks-foot grass	_____	O	I	I	I
Dogs-tail grass, crested	_____	I			
_____ water	_____	I	I	I	O
Fescue grass, fiste	_____	O	I	I	I
_____ purple	_____	I	I	I	I
_____ sheep's	_____	I	I	I	I
Brome grass, large	_____	I	I	I	I
_____ field	_____	I	I	I	I
_____ mountain	_____	I	I	I	I
_____ hedge	_____	I	I	I	I
Oat grass, meadow	_____	I	I	I	I
_____ bearded	_____	I	I	I	I



It is wonderful to see how long mankind has neglected to make a proper advantage of plants of such importance, and which in almost every country are the chief food of cattle. The farmer for want of distinguishing, and selecting grasses for best hills, sows either with weeds, or the worst grasses, when by making a right use of the grasses he is the great abundance that his land is capable of. At present if a farmer wants to lay down his land to grass, what does he do? he either takes his seeds indiscriminately from his own fool hayrick, or sends to his next neighbour for a supply. By this means, besides a certain mixture of all sorts of rubbish, which must necessarily happen, it be Ob-



Observations on GRASSES.

AS the foregoing treatise contains some observations on grasses, that are quite new, and as this affair is of the utmost importance to the husbandman, I shall subjoyn some observations of my own relating to the same subject.

It is wonderfull to see how long mankind has neglected to make a proper advantage of plants of such importance, and which in almost every countrey are the chief food of cattle. The farmer for want of distinguishing, and selecting grasses for feed, fills his pastures either with weeds, or bad, or improper grasses; when by making a right choice, after some trials he might be sure of the best grass, and in the greatest abundance that his land admits of. At present if a farmer wants to lay down his land to grass, what does he do? he either takes his seeds indiscriminately from his own foul hayrick, or sends to his next neighbour for a supply. By this means, besides a certain mixture of all sorts of rubbish, which must necessarily happen; if he
chances

chances to have a large proportion of good seeds, it is not unlikely, but that what he intends for dry land may come from moist, where it grew naturally, and the contrary. This is such a slovenly method of proceeding, as one would think could not possibly prevail universally; yet this is the case as to all grasses except the darnel grass, and what is known in some few counties by the name of the Suffolk grass; and this latter instance is owing, i believe, more to the soil than any care of the husbandman. Now would the farmer be at the pains of separating once in his life half a pint, or a pint of the different kinds of good grass seeds, and take care to sow them separately; in a very little time he would have wherewithal to stock his farm properly, according to the nature of each soil, and might at the same time spread these seeds separately over the nation by supplying the seed-shops. The number of grasses fit for the farmer is, i believe, small; perhaps half a dozen, or half a score are all he need to cultivate; and how small the trouble would be of such a task, and how great the benefit, must be obvious to every one at first sight. Would not any one be looked on as wild who should sow wheat, barley, oats, rye, peas, beans, vetches, buck-wheat, turneps and weeds of all sorts together? yet how is it much less absurd to do what is equivalent in relation to grasses?

grasses? does it not import the farmer to have good hay and grass in plenty? and will cattle thrive equally on all sorts of food? we know the contrary. Horses will scarcely eat hay, that will do well enough for oxen and cows. Sheep are particularly fond of one sort of grass, and fatten upon it faster, than on any other in Sweden, if we give credit to Linnæus. And may they not do the same in England? How shall we know till we have tried? Nor can we say that what is valuable in Sweden may be inferior to many other grasses in England; since it appears that they have all the good ones that we have. But however this may be i should rather choose to make experiments, than conjectures.

I now propose to add a few observations on some of our grasses, as far as i have been able to make any with some appearance of probability; but as there has reigned hitherto the greatest confusion in the English names of these most valuable plants, and as they have never been properly ranged but by Linnæus, i shall first, in imitation of that great author in his *Flora Suecica*, give new generical names with trivial ones to distinguish the species of all our English grasses. I mean all those which are found in that author; as for the rest, since some are omitted by him, their names may be easily supplied when their genera are settled by the learned. It happens
very

very luckily, that our common people know scarce any of the grasses by names, as far as i could ever find by conversing with farmers, husbandmen, &c. so that something may be done to remove this confusion, if a list of names be settled and agreed on by such as are likely to have influence sufficient in these matters. As to my own list, it is only meant as a hint for others to work upon.

In giving names i have had two things in view. First, to retain as much as possible such as have hitherto been used for some of the genus. Secondly, where that could not be done, to give such as are of easy and familiar pronunciation to our common people, and at the same time approach as near as possible to the Latin names in sound where they could not be interpreted. This was done for the sake of the learned for the more easy recollecting the botanical name. Thus i have called the *aira* hair-grass, the *bromus* brome grass, &c. in others i have merely translated the Latin name, as *alopecurus* fox-tail grass, *cynosurus* dog-tail grass, &c.

After these preliminary observations i hope it will not be necessary to make any apology for the liberty i have taken. I am certain that till names properly adapted to the purpose be invented, we have little chance of seeing any general reformation made in this part of husbandry; and even after
this

this without some person properly qualified to direct the country people, and shew them the grasses with their names, nothing will come of that most useful doctrine delivered in the foregoing treatise. But it is to be hoped that gentlemen at least will not be so incurious as to remain ignorant of what imports them so much to know. Nor is the mere botanist less concerned in the success of this scheme, for there is great reason to think that many of the grasses are not thoroughly settled, varieties perhaps being put for different species; now this uncertainty can never be better cleared up than by sowing the same kind of seeds on different soils.

A Table of English GRASSES.

GENUS 1.

Linnaeus. Ray.

Spring grass anthoxanthum 398. 1

GENUS 2.

Mat-grass nardus 1 393. 2

* Thus Gmelin Flor. Lapp. mentions four of the poor grasses which he says have for a long time perplexed botanists of great reputation. And the editor of Ray's Synopsis, p. 402. doubts whether five grasses which are put down as different by Petiver be not only varieties of a grass mentioned before. I have many specimens of this grass in my collection differing in color, stature and outward aspect, which yet most likely are of the same species.

G E.

*Formal Grass with
a loose yellowish
spike
Graminoparlem
Junifolium*

(207)

GENUS 3.

	Canary-grass	Linnaeus.	Ray.
		Phalaris	
<i>Manured</i>	1	1	394. 1
<i>Spiky</i>	2	2	398. 2
<i>Reed</i>	3	3	400. 1
<i>Striped</i>	4	3.b.	400. 2

GENUS 4.

	Panic grass	Panicum	
<i>Loose</i>	1	2	394. 2
<i>Broad-leaved</i>	2	8	399. 2
<i>Creeping</i>	3	15	399. 1

GENUS 5.

	Cats-tail grass	Phleum	
<i>Meadow</i>	1	1	398. 1
<i>Sea</i>	2	3	984. 4

GENUS 6.

	Fox-tail grass	Alopecurus	
<i>Meadow</i>	1	1	396. 1
<i>Water</i>	2	2	396. 2

GENUS 7.

	Millet grass	Milium	
		1	402. 1

GENUS 8.

	Bent grass	Agrostis	
<i>Silky</i>	1	1	403. 5
<i>Late</i>	2	4	399. 4
<i>Creeping</i>	3	7	402. 2
<i>Fine</i>	4	8	402. 4
<i>Small</i>	5	10	Append.

G E.

Protent: Grubbe
Arundinaceum
Bractea species
Multiplex rubra
Nov. 190. Fig 38.

(208)

GENUS 9.

Linnæus. Ray.

Hair grafs

Aira

<i>Roughish</i>	1	2	396. 3
<i>Purple</i>	2	3	404. 8
<i>Water</i>	3	6	402. 3
<i>Turfy</i>	4	8	405. 17
<i>Small-leaved</i>	5	9	407. 9
<i>Grey</i>	6	12	405. 16
<i>Early</i>	7	13	407. 10
<i>Silver</i>	8	14	402. 7

GENUS 10.

Melic grafs

Melica

2 403. 6

GENUS 11.

Poa grafs

Poa

<i>Water</i>	1	1	411. 3
<i>Common</i>	2	3	409. 2
<i>Narrow-leaved</i>	3	4	409. 4
<i>Broad-leaved</i>	4	5	504. 3
<i>Annual</i>	5	6	408. 1
<i>Creeping</i>	6	15	409. 5

GENUS 12.

Quaking grafs

Briza.

<i>Great</i>	1	1	412. 2
<i>Small</i>	2	2	412. 1

GENUS 13.

Cocks-foot grafs

Dactylis

2 400. 2

G E-

(209)

Linæus: Ray:

GENUS 14.

Dog-tail grafs

Cynofurus

<i>Crested</i>	1	1	398. 2
<i>Rough</i>	2	2	397. 5
<i>Water</i>	3	5	398. 4
<i>Clinging</i>	4	8	394. 3

GENUS 15.

Fescue grafs

Festuca

<i>Sheeps</i>	1	1	410. 9
<i>Branching</i>	2	2	413. 4
<i>Purple</i>	3	4	411. 16
<i>Wall</i>	4	5	415. 12
<i>Eared</i>	5	7	415. 13
<i>Crawling</i>	6	8	408. 11
<i>Flote</i>	7	10	412. 17

GENUS 16.

Brome grafs

Bromus

<i>Large</i>	1	1	414. 8
<i>Barren</i>	2	5	412. 1
<i>Field</i>	3	6	413. 5
<i>Mountain</i>	4	7	414. 7
<i>Wood</i>	5	9	415. 11
<i>Hedge</i>	6	10	392. 1

GENUS 17.

Feather grafs

Stipa

393. 3

GENUS 18.

Oat grafs

Avena

<i>Tall</i>	1	2	406. 4.
	P		<i>Manured</i>

Linæus: Ray:

<i>Manured</i>	2	5	389.
<i>Bearded</i>	3	6	389. 7
<i>Yellow</i>	4	7	407. 5
<i>Meadow</i>	5	9	405. 1

GENUS 19.

Reed grafs		Arundo	
<i>Thatch</i>	1	3	401. 1
<i>Branching</i>	2	5	401. 2
<i>Pointed</i>	3	6	393. 1

GENUS 20.

Darnel grafs		Lolium	
<i>Perennial</i>	1	1	395. 2
<i>Annual</i>	2	2	395. 1

GENUS 21.

Lyme grafs		Elymus.	
		1	390. 3

GENUS 22.

Rye-grafs		Secale	
<i>Manured</i>	1	1	388. 1
<i>Wild</i>	2		392. 4

GENUS 23.

Barley grafs		Hordeum	
<i>Manured</i>	1	1	388. 12
<i>Wild</i>	2	5	391. 1

GENUS 24.

Wheat grafs		Triticum	
<i>Manured</i>	1	1	386. 1
<i>Creeping</i>	2	6	390. 1
<i>Dog</i>	3	7	390. 2
			Soft

Linnaeus. Ray.

GENUS 25.

Soft grass Holcus

404. 14.

Genus the first, spring grass.

This grass grows very commonly on dry hills, and likewise on found rich meadow land. It is one of the earliest grasses we have, and from its being found on such kinds of pastures as sheep are fond of, and from whence excellent mutton comes, it is most likely to be a good grass for sheep pastures. It gives a grateful odor to hay.

Genus sixth, meadow fox-tail grass.

This grass as well as the foregoing is found in great plenty in our best meadows about London, and I believe makes very good hay. Linnaeus says that it is a proper grass to sow in grounds that have been drained.

Water fox-tail grass.

This is also found in our meadows about town, that are found but lye under water, and perhaps might be proper to sow on such grounds.

Genus seventh, millet grass.

Linnaeus Flor. Lappon says that between Tornea, Kemi, and Ulpa no grass is more common than this. If one considers, says he, its stature and sweet odor, we shall be inclined to rank this amongst the best grasses.

Fine bent grass.

This grass I have always found in great plenty

on the best sheep pastures, as on Malvern hills and all the high grounds in Herefordshire, that are remarkable for good mutton.

Genus ninth, silver hair grass.

The same may be said of this as of the foregoing. I will add that i never could find any other but these two, and the spring grass on Malvern hill.

Genus eleventh, narrow and broad leaved poa grass.

These are common in our best meadow grounds, and i believe make good pasture and hay.

Annual poa grass.

This grass makes the finest of turfs. It grows every where by way sides, and on rich found commons. It is called in some parts the Suffolk grass. I have seen whole fields of it in high Suffolk without any mixture of other grasses, and as the best salt butter we have in London comes from that county, it is most likely to be the best grass for the dairy. I have seen a whole park covered with this grass in Suffolk, but whether it affords good venison i cannot tell, having never tasted of any from it. I should rather think not, and that the best pasture for sheep is also the best for deer. However this wants trial. I remarked on Malvern hill something particular in relation to this grass. A walk that was made there for the convenience of the water drinkers, in less than a year was covered in many places with this grass, tho' i could

I could not find one single plant of it besides in any part of the hill. This was owing no doubt to the frequent treading, which above all things makes this grass flourish, and therefore it is evident that rolling must be very serviceable to it.

Genus fourteenth, crested dog-tail grass.

This grass I imagine is proper for parks. I have known one where this abounds that is famous for excellent venison. It may perhaps be as good for sheep.

Genus fifteenth, sheeps fescue grass.

This is the grass so much esteemed in Sweden for sheep.

Gmelin Flor. Lap. says, that the Tartars choose to fix during the summer in those places where there is the greatest plenty of this grass, because it affords a most wholesome nourishment to all kinds of cattle, but chiefly sheep; and he observes that the sepulchral monuments of the antient Tartars are mostly found in places that abound with this grass, which shews, adds he, that it has long been valued amongst them.

I have among my grasses a specimen of it, but do not remember where I found it. I am certain it is not common in any of the places where I have been. Perhaps upon examination it may be found on places famous for our best mutton, as Barnstead Downs, Church-Stretton in Shropshire, Wales, &c.

Flote fescue grass.

I have no knowledge of the quality of this

grafs from my own experience, but I shall quote something concerning it out of a piece published in the *Amœn. academ.* vol. 3. entitled *Plantæ efculentæ*. The author says there, artic. 90. that the seeds of this grafs are gathered yearly in Poland, and from thence carried into Germany and sometimes into Sweden, and sold under the name of manna seeds. They are much used at the tables of the great on account of their nourishing quality and agreeable taste. It is wonderfull, adds the author, that amongst us these seeds have hitherto been neglected, since they are so easily collected and cleaned.

This grafs is very common in England.

Genus twentieth, perennial darnel grafs.

This grafs is well known and cultivated all over England; and it is to be hoped the success we have had with it will in time encourage our farmers to take the same pains about some others, that are no less valuable, and are full as easy to be separated. It makes a most excellent turf on found rich land where it will remain. If I may judge by the venison I have eat out of a paddock, that was chiefly filled with this grafs, I would by no means recommend it for parks. I know it will be said that venison is never good out of a paddock, that the deer must have room to range, trees to browse on, &c. I grant there is some reason for saying this, but I believe in general it is more owing to want of proper food, viz. good grafs,

grass, than merely to confinement; for paddocks are generally made by converting some rich spot near the house that has been constantly manured, and of course is full of grasses fitter for the dairy or the stable than for deer, which hardly ever is the case of large parks. No man will, I suppose, pretend to make good pork from a hog fed with grains instead of peas, tho' he has the liberty of choosing as much ground as he pleases, and where he pleases. This grass is called in many counties rye grass. It were to wished that the old name might prevail, because there is a genus of grass viz. 22d. known by the name of rye all over the kingdom, of which genus there is a wild species that ought to bear the same generical name.

As to grasses in general I must observe, first, that those grasses only which throw out many leaves from the root seem to be worth propagating for hay or pasture, for a reason given in one of the foregoing treatises viz. that cattle will not touch the flowering stems, as every one must have observed who has observed any thing about grasses.

Secondly, I am sensible that we cannot have what grasses we please on every ground. But it does not follow, because we cannot have the best, that we must have the worst. I saw the last summer at Lhanberis in Carnarvon-

shire the poor inhabitants with infinite labor mowing grafs for hay, which consisted chiefly of the purple hair grafs genus ninth, which was of so hard nature that it required a stroke like what would have felled a small tree to mow it, and this not ripe till the latter end of August. Now had these people the practice of getting good grafs seeds they might be furnished with a grafs much sooner ripe, which is of great consequence in a place where there is very little fertile ground, and where the sun never reaches for full three months in the year; for they would procure a better aftermath, have more nourishing fodder for the cattle in winter, and not be at the tenth part of the pains in mowing.

Thirdly, It is surprising to see almost all over England that the lands which the farmer pays the most for are the most neglected. I mean grafs lands, which are generally filled with rubbish. This happens, i believe, in part because the farmer thinks it is the nature of some lands to run to bad grafs. This i have heard many times asserted, and the assertion is thus far right, that if ground be not properly drained and cleaned, the grafs most natural to a bad soil will prevail let him sow what grafs he pleases; but this will likewise be the case of his corn fields if he neglects them, they will no doubt be over-run with weeds, and his crop will come to nothing.

I have

I have seen fields of barley so full of corn-mary-
gold that the crop was not worth cutting.*

Fourthly, I have known a gentleman deterred
from new laying with grass the grounds about his
house where the turf was but ordinary, because
the farmers told him it would take seven years to
get a good turf. I agree with them in part, but i
am against limiting the time to seven years.
They might have said seventy times seven, for
in their way of going to work they will never
get a good turf at all. And therefore till there
is a better way practised i think it would be right
to bear with an indifferent turf rather than run
the risque of a much worse for many years, viz.
till at last the grass, such as it is, prevails in part
over the weeds, which will always happen by
mowing and feeding. But if they mean that it
will take seven years to get a good turf with
good and proper seeds, i totally dissent from them,
for i have seen such a turf procured in one year on
land properly laid down with the Suffolk grass
seeds. I will not say this will be the case with
all hay seeds, for this grass spreads remarkably by
the roots. I have counted forty-three flowering
stems besides a great number of radical leaves

* Linnæus says Flor. Sue. 762. that the Danes are obliged
by law to extirpate this weed out of their fields, and from
them i suppose this law was established here; for it ap-
pears by the court rolls of a friend of mine in Norfolk, that
the tenants were fined if this plant was found in their lands.
It is called there buddle.

from one root of this kind without particularly searching for a vigorous plant, and this plant was not above three weeks growth. It is supposed by Linnæus to be an annual; but i have some doubt of this, because i never observed its leaves withered. However it has one property that would incline me to think it an annual, which is, that if the flowering stems be cut down it will flower again the same year, and this continually, which is, i observe, the case of all annuals, and which i have not observed in grasses, that are perennial.



A P P E N D I X.

PAGE 50. line 20. there is a mistake in the translation, for *primrose* read *cowslip*. This curious phenomenon did not escape the poetical eye of Milton, who was so very much struck with the beauty of it, that he thought it worth describing in the following enlivened imagery,

With cowslips wan that hang the pensive head.

P. 85. line 8. Many opinions, says the author in the note, have been started in order to account how it happens that fishes are found in pools, and ditches, on high mountains and elsewhere. But Gmelin observes that the duck kind swallow the eggs of fishes, that some of these eggs go down, and come out of their bodies unhurt, and so are propagated just in the same manner, as has been observed of plants. Biberg.

Gmelin adds, that the Siberians themselves account for this phenomenon in the manner above mentioned.

P. 88. note g. Since i wrote this note i have found the passage in Herodotus. It is lib. 2. p. 109. Edit. Steph. where he says, that swallows and kites continue all the year about the springs of the Nile. What he mentions concerning kites deserves some notice.

Aristotle says that kites lye concealed in holes a few days. Pliny says a few months. Gesner repeats the same, adding that they have been found in hollow trees somewhere in Upper Germany, but he seems to relate this upon hearsay only. Aldrovandus gives the same account as Gesner, and adds that they winter in Egypt, but whether upon the authority of Bellonius or any other credible writer, does not appear. He quotes a passage from that author concerning the appearance of a vast number of kites at the mouth of the Bosphorus, but this happened at the latter end of May, and seems to prove nothing; for the time marked for their appearance by Calippus, who observed near the Hellespont, is the month of March. Willughby says that kites are supposed to be birds of passage, and then quotes from Bellonius the place above-mentioned.

From what has been said it appears evident, that nothing certain is known by the moderns about the disappearance of these remarkable birds, yet their coming was regularly noted by the ancient

cient writers, and coincided with that of swallows, as appears by the old calendars of Geminus, and Ptolemy from the observations of Eudoxus, Euctemous, Calippus, and Dositheus.

P. 112. note o. I am assured from good authority, that in the year 1739 the thermometer did not sink 9 degrees below freezing point in England. They who are curious to see much more surprizing instances of cold than that in Sweden, may consult the preface to Gmelin's *Flora Sibirica*, where they will find how very apt philosophers are to fall into mistakes about the powers of nature, when they trust to theory, instead of consulting experience. Mons. Maupertuis says, that the mercury in Reaumur's thermometer in Lapland sunk to 37 degrees below freezing point, which is equal to 67 degrees in Farenheit. Perhaps, says Linnæus in the *Flora Lapponica*, the curious reader will wonder how the people in Lapland during the terrible cold, that reigns there in winter, can preserve their lives; since almost all birds, and even some wild beasts, desert it at that time. The Laplander not only in the day, but thro' whole winter nights is obliged to wander about in the woods with his herds of rein deer. For the rein deer never come under cover, nor eat any kind of fodder, but a particular kind of liverwort. On this account the herdsmen are under a necessity of

of living continually in the woods, in order to take care of their cattle, lest they should be devoured by wild beasts. The Laplander easily does without more light, as the snow reflects the rays that come from the stars, and as the aurora borealis illuminates the air every night with a great variety of figures. The cold is so great that foreigners are kept aloof, and even deterred from their most happy woods. No part of our body is more easily destroyed by cold than the extremities of the limbs, which are most remote from the sun of this microcosm, the heart. The kibes that happen to our hands, and feet, so common in the northern parts of Sweden, prove this. In Lapland you will never see such a thing, altho' were we to judge by the situation of the countrey we should imagine just the contrary, especially as the people wear no stockings, as we do, not only single but double, and triple. The Laplander guards himself against the cold in the following manner. He wears breeches made of rein deer skins with the hair on, reaching down to his heels; and shoes made of the same materials, the hairy part turned outwards. He puts into his shoes slender-eared broad-leaved cyperus grass, that is cut in summer and dried. This he first combs, and rubs in his hands, and then places it in such a manner, that it not only

covers

covers his feet quite round, but his legs also; and being thus guarded, he is quite secured against the intense cold. With this grass they stuff their gloves likewise, in order to preserve their hands. As this grass keeps off the cold in winter, so in summer it hinders the feet from sweating, and at the same time preserves their feet from being annoyed by striking against stones, &c. for their shoes are very thin, being made, not of tanned leather, but the raw hide. It was difficult for me to find what particular kind of grass they prefer for this purpose, as not being every where the same, tho' always one of the cyperus grasses, but I perceived at last that it was what I mentioned above. Thus far Linnaeus. I will add, that this grass grows with us.

P. 118. Illustration of the former part of note g. It appears from Geminus in his elements of astronomy, that the coincidence of the seasons as to heat, cold, rain, &c. with the risings and settings of the stars, had caused a notion to prevail among the ancients, that these celestial phenomena were not merely the signs, but the causes of the different seasons. This notion, which he takes some pains to overturn, would never have begun in such uncertain climates, as are found in these parts of the world. But in Egypt, where the Nile begins to rise regularly upon the appearance

pearance of Sirius, or the dog-star, where the Etesian winds begin, and cease to blow constantly about the same time of the year; and in general the variation of the weather is nearly uniform, such a notion might easily prevail in the minds of an unenlightened, and superstitious people. From them it was propagated into Greece, where, tho' it must have been frequently thwarted by a much less constant uniformity, yet it might still be upheld by that blind veneration, which generally attends antiquity, especially amongst the ignorant, and unlearned. As for the Romans, they went still farther, for without even adapting an almanack to their own climate and time, they fixed the seasons for husbandry-work of all kinds by the risings and settings of the stars, such as they found them in the Greek calendars. To this custom Geminus certainly alludes when he observes, that an almanack, which may pretty well foretell the weather in one countrey is good for nothing in another, as one would think should be obvious at first sight. Yet this he thought necessary to explain, and dilate upon, in order to convince the Romans of their error; for tho', as Petavius observes, the later astronomers went more accurately to work, the prejudice still remained in the minds of the countrey people, and the vulgar. Whether Geminus thought those predictions concern-

ing

wold

blow, and the grasshopper chirps upon trees, which, as Theophrastus observes, was about the summer solstice, then goats are in full season, &c. That when the fig leaf is about as big as a crow's foot, the time for sailing comes on. That when the voice of the crane is heard overhead, then is the time for ploughing. It is true, the poet frequently marks the seasons by the risings and settings of the stars, and as astronomy, besides its many important uses, is connected with the finer sciences, has something in it very striking to the imagination, and has been cultivated by men, who had leisure to make calendars for general use, it was natural that it should get the ascendant over rules surer perhaps in themselves, and more adapted to the purpose of the husbandman, but which were destitute of the advantages abovementioned, and were most probably looked on only as poetical embellishments.

Addition to the latter part of the same note.

To the instance of coincidence of the appearance of the cuckow, and the fruit of the fig-tree in Greece and England, I will here add some coincidences of the like nature in Sweden and England.

Linnaeus says, that the wood-anemone blows from the arrival of the swallow. In my diary for the year 1755, I find the swallow appeared April the 6th, and the wood-anemone was in
 blow

blow the 10th of the same month. He says, that the marsh-marygold blows when the cuckow sings. According to my diary the marygold was in blow April the 17th, and the same day the cuckow sung.

I have many other observations by me about the appearances of birds and the flowering of plants, but as they were made for one year only, and there are none of other authors to compare them, with i shall not trouble the reader with them.

P. 143. towards the bottom, *in the woods of both the Indies*, I omitted translating two or three words in this passage, not knowing what to make of them. The words are in *fagorum filvis*; but I find upon looking into the last edition of the *Flora Suecica* of Linnæus, that the beech is particularly destructive of vegetation, which i had never observed of that tree, but frequently of the fir-kind. The passage should stand thus: In beech groves, and in the woods of both the Indies.

P. 193. l. 5. dye in heaps. This affair is of so much consequence to the farmer, that i think it right to transcribe a passage out of Linnæus upon this subject.

When I arrived, says he, at Tornea, the inhabitants complained of a terrible disease, that raged among the horned cattle, which upon being let into the pastures in the spring dyed by

hundreds.

hundreds. They desired that i would consider this affair, and give my advice what was to be done in order to put a stop to this evil. After a proper examination i thought the following circumstances worth observing.

1. That the cattle dyed as soon as they left off their winter fodder, and returned to grazing.

2. That the disease diminished as the summer came on, at which time, as well as in the autumn, few dyed.

3. That this distemper was propagated irregularly, and not by contagion.

4. That in the spring the cows were driven into a meadow near the city, and that they chiefly dyed there.

5. That the symptoms varied much, yet agreed in this, that the cattle, upon grazing indiscriminately on all sorts of herbs, had their bellies swelled, were seized with convulsions, and in a few days expired with horrible bellowings.

6. That no man dared to flea the recent carcasses, as they found by experience, that not only the hands of such as attempted it, but their faces too had been inflamed, and mortified, and that death had ensued.

7. The people enquired of me whether there were any kinds of poisonous spiders in that meadow, or whether the water which had a yellowish tint was not noxious.

8. That

8. That it was not a murrain was clear, because the distemper was not contagious, and because that distemper is not peculiar to the spring. I saw no spiders but what are common all over Sweden; and as to the water, the sediment at the bottom, that caused the yellowness, was nothing but what came from iron.

9. I was scarcely got out of the boat, which carried me over the river into the meadow, before I guessed the real cause of the disease. For I there beheld the long-leaved water hemlock. My reasons for guessing this were as follow.

10. Because in that meadow, where the cattle first fell ill, this poisonous plant grows in great plenty, chiefly near the banks of the river. In other places it was scarce.

11. The least attention will convince us that brutes shun whatever is hurtfull to them, and distinguish poisonous plants from salutary by natural instinct; so that this plant is not eat by them in the summer, and autumn, which is the reason that in those seasons few cattle dye, viz. only such as either accidentally, or pressed by extreme hunger, eat of it.

12 But when they are let into the pastures in spring, partly from their greediness after fresh herbs, and partly from the emptiness and hunger which they have undergone during a long winter, they devour every green thing which comes in their way.

way. It happens moreover that herbs at this time are small, and scarcely supply food in sufficient quantity. They are besides more juicy, are covered with water, and smell less strong, so that what is noxious is not easily discerned from what is wholesome. I observed likewise, that the radical leaves were always bitten, the others not; which confirms what I have just said.

13. I saw this plant in an adjoining meadow mowed along with grass for winter fodder; and therefore it is not wonderfull, that some cattle, tho' but a few, should dye of it in winter.

14. After I left Tornea I saw no more of this plant till I came to the vast meadows near Limmingen, where it appeared along the road, and when I got into the town I heard the same complaints, as at Tornea, of the annual loss of cattle with the same circumstances.

15. It would therefore be worth while to eradicate carefully these plants, which might easily be done, as they grow in marshy grounds; and are not hard to find, as they grow by the sides of pools or rivers. Or if this could not be done, the cattle should not be suffered to go into such places, at least during the spring. For I am persuaded, that later in the year they can distinguish this plant by the smell alone.

The E N D.



